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The Small Consumer

We take great pleasure in publishing in this issue the results of an elaborate investigation by Mr. S. E. Doane of electrical distribution for the small consumer in Europe. His article records an immense amount of labor well spent in collating the facts regarding the methods used by the Continental electric-light stations to increase their business by reaching the humble homes heretofore lighted only with gas or petroleum. We have double pleasure in commending this investigation to the earnest attention of our readers since for half a dozen years past we have been hammering steadily away at this neglected duty of the central station toward the public. We have felt sometimes as if our voice were one crying in the wilderness, but the time has now come when accomplishment seems less distant and reiteration of the facts less futile.

As every observing investigator knows, in most American cities the use of electric light in homes of the humbler class is limited. We say this advisedly, since in the examination of most urban territory where gas and electric companies coexist the latter will be found putting in their time in building up the business of supplying energy to commercial installations of motors and lamps, while the former will be found to live and move and have their being in and pay their dividends—generally liberal ones—from chiefly those small consumers whom the central-station man, drunken with fanciful ideas of expansion, has neglected altogether. In recent years gas has been well-nigh driven out of the larger commercial field, and gas companies make their earnings by lighting the small home and furnishing gas wherever needed for heating and cooking purposes. In these latter functions, save for a few industrial uses, they find the large business upon which they live.

Mr. Doane has gathered a mass of statistics from abroad which ought to be convincing evidence that electric companies have not only missed an opportunity but have failed to perform a plain duty in reaching the whole of the public. The data collected bear chiefly upon three things—methods of getting business, methods of making installations, and the establishment and collection of charges for service. Competition between gas and electricity abroad is keener than here, and the gas companies, pushed out of their profitable commercial field, promptly intrenched themselves in the home, making deliberate and highly successful efforts to cause every householder to become a gas user and a friend of the gas company. It is only recently that the electric supply companies have realized the situation and appreciated that a contented customer is a good friend when a political hue and cry is raised against a public utility. In our own cities the man on the street is even more important by reason of our form of government, yet he has been persistently neglected.

To render effective a campaign for business on a small scale suitable methods of charging, bookkeeping and collection are necessary. In this country use is made for the most part of an elaborate system which discourages small business on account of the large fixed charges. The Continental small-business campaign is carried on at the present time mostly by some kind of flat-rate scheme, so much per lamp per month, with a cheap current-limiting device to prevent the installation of larger lamps than those bargained for. The meter, with its maintenance charges, its cost of reading and its participation in the long procession of entries in the bookkeeping department, is cast into outer darkness. Only in rare instances is metering employed in this class of work on the Continent, and then only as an alternative. In the larger business the meter system is very generally employed in much the same form as in this country.

The favorite method of charging for small business is a flat rate paid in advance, with the simplest kind of system for collection and bookkeeping, sometimes by means of regular collectors, again by the aid of the post office or of local shopkeepers—in fact, any way to keep down expense. As to results it is found from experience that the flat rate thus administered enables the stations to serve at a profit even the very smallest consumers. It is not found that the flat rate leads to an abuse of privileges in using the lamps. The extent of use is, to be sure, very variable, but it averages well, say, between four and six hours per day, which at the rates customarily charged leads to returns per kilowatt-hour actually used quite up to the ordinary. Such, indeed, has been the experience in our own country wherever the flat-rate system has been intelligently and skilfully applied. In Continental as in American practice a current-limiting device is generally installed, but free renewals are not given, since the renewal cost of the tungsten lamp seems to serve as a useful check against too persistent burning.

The secret of the success reached on the Continent in dealing with these small consumers seems to be in coupling a cheap wiring system on the instalment plan with a flat-rate method of charging which makes the price to be paid perfectly definite and collects it in ad-

vance. There are few American cities in which a similar policy would not bring profitable results when once fairly under way. People must have light and would always use electric light if it were to be had without too much expense. Yet for some inscrutable reason the policy of most American central-station managers has been such that the solicitor would rather spend a week trying to place a small electric sign over a suburban beer saloon than put in the same time to the greater profit of his station in obtaining the much despised small consumer. We trust that Mr. Doane's far-reaching investigation of the facts as disclosed in European practice will lead to better things. If the central-station manager is tempted to despise small payments, let him take notice that the whole street-railway business lives upon nickels. If the supply manufacturer prefers to sell only high-priced equipments, let him consider the greater business that can be done in reaching the large number of humble homes where electricity is not now known.

Some New Methods in Shop Illumination

An account of some very striking innovations in department-store lighting is published in the article beginning on page 1145 of this issue. The illumination of such a store has always been rather troublesome on account of the nature of the spaces and the necessity of having as far as possible good color values in the illuminants. In the present instance the engineer who planned the installation awoke to a realization that the illumination of the shop windows, for example, is essentially a bit of stage setting, to be treated according to theatrical rather than ordinary precedents. He therefore worked out a window-lighting system with foot-lamps and border-lamps, equipped, as in the best stage practice, with movable color filters giving whatever tone may be desired at the time for the illumination of the objects on the stage. It is found that the use of such filters is much better than staining the lamps, as the colors stand better and can be changed with the utmost ease. In the window lighting, therefore, any display can have an appropriate and effective color of illumination and plenty of it, thanks to the efficiency of modern light sources. The fundamental lighting of the building, too, is carried out with color values in mind. It is of the semi-indirect type, and the diffusing bowls are lined with bluish bowls which serve as color screens, giving in the general illumination of the store a much closer approximation to daylight effects than could be obtained by the use of any single type of unscreened illuminant.

This scheme is carried still further in the special provision for trying on theatrical costumes. Here are not only the general provisions for color modification, but foot-lamps and border-lamps fitted with dimmers, and also the customary spot-lamps for special effects. Taken as a whole the installation furnishes an admirable instance of scientifically designed lighting especially arranged to meet the exacting requirements of its use and to provide for every variation in color tone that may be necessary most effectively to display the goods on sale. In addition to these particular features the plant is thoroughly up to date and worthy of attentive consideration.

Transformer Core-Loss Separation

Core-losses are always present in electrical machinery, as a cheerful reminder that nothing in this world can be perfect. A reasonable amount of core-loss is, therefore, a thing that no good-natured engineer will protest against. Core-losses are attributed to two different phenomena; namely, hysteretic loss and eddy-current loss. The former is essentially magnetic and the latter electric. The two effects follow very different laws. The former is considered to be largely independent of temperature and to depend solely on the frequency as well as on the 1.6th exponent of the flux density. The latter is considered to vary as the square of the frequency and to be affected by temperature variations in resistivity. Consequently, it is assumed that by operating a core at cycles of varying frequency it becomes possible to find how much loss varies as the first power, and how much as the second, in order to separate the hysteretic sheep from the eddy-current goats.

When careful measurements are made in the laboratory, upon cores specially selected and wound, it is not easy to draw the line precisely between sheep and goats. The sheep refuse to conform strictly to the first power, and the goats also decline exactly to obey the second power of the frequency throughout any considerable frequency range. The fact seems to be that the 1.6th power is only a first approximation to the energy-versus-density relation, while the skin effect of the eddy currents distorts the flux distribution from uniformity to a condition of greatest density at the surface of the laminas and least at their mid-plane. The analysis of core-loss into hysteretic and eddy-current components, even under laboratory conditions, thus often becomes very difficult, when accurate division is attempted.

Finally, when the core of some actual machine or apparatus, such as the core of an assembled transformer, is tested, the difficulties are further increased. Some eddy-current loss in the copper coils throws itself in a sympathetic but sadly perplexing way into the measured total. The flux density in the steel varies, not only owing to eddy-currents, but also on account of mag netic and mechanical departures from symmetry. The result is that analysis based on losses measured at different frequencies becomes inconsistent, and the relative distribution of sheep and goats becomes doubtful in yet larger degree. In the case of very complicated and irregular cores one may have to be content with rough approximations only. Fortunately, in most engineering work, it suffices to measure the core-losses as a whole, and, accepting the quadruped analogy, statistical

inquiries into the relative proportions of generic types become a matter of merely zoölogical interest.

The article by Prof. E. R. Shepard which appears in this number, on a practical example of transformer core-loss separation, illustrates the above-mentioned difficulties in the way of accurate analysis. In this case the core-losses of a transformer were measured at two different frequencies. The hysteretic loss was also measured by flux-meter, at a frequency which must have been substantially zero. From these data the analysis into hysteresis and eddy-current losses is made in several different ways. These are in agreement to a first approximation. It appears, for example, that at a computed flux density of 9 kilogausses the core-losses were about equally divided in the ratio of two-thirds hysteresis and one-third eddies; but if a division of 1 per cent precision were required, it would be very difficult to comply. Far from being discouraged, however, by such discrepancies, we should be stimulated by the conclusions from such tests to renewed vigor in attacking the experimental problem, with a view to obtaining, when necessary, more precise results. This application of the article rests over and above that indicated by Professor Shepard, as to the wholesome effects of such studies on the student mind.

The Utility Holding Company

Representatives of holding companies in the public utility industry are urging Congress to exempt such companies from the operation of the trust regulation bill. Arguments in support of their proposition, presented before a committee of the Senate on May 12, were published in last week's issue. The arguments dealt more with the finances of the holding company than with the operating point of view. There is economic justification for the public utility holding company from both points of view, but it would have made the case stronger if operating officials had explained the technical questions involved. The public utility holding company confronts at present the fact that the holding company as an institution is regarded by the Washington administration and leaders as intrinsically undesirable. Sweeping as this judgment is, the burden rests upon the public utility holding companies to show that they should not be classed with the general type of holding company, that their operations are limited to local public utilities and that they do not unreasonably restrain trade. These facts are so plain to public utility operators that these men can scarcely realize that their corporations may be condemned by the new law. If Congress chooses to legislate against public utility holding companies, it should do so with a perfect understanding of their function. It would be extremely unfortunate if Congress should legislate against companies of this nature without a perfect understanding of their purpose or without a definite intention on its part to bring such companies within the scope of the law. It is to guard against such a contingency that the *Electrical World* has urged representatives of the companies to defend their position.

The normal business of the public utility holding company is the control and management of a number of plants furnishing gas, electric or other forms of public utility service, these plants being generally widely separated physically. This holding company does not seek to dominate an entire industry. It does seek to perfect monopoly of its service in each community for reasons of economy to itself and the public it serves. Its desire so to do and the large uncertainties that arise in the definition of the term "interstate commerce" make jurisdiction by Congress a matter of certainty in many cases and a matter of probability or construction of the law in others. We contend that the question of the public policy of monopoly of each class of public utility service in a single community is not one that is before Congress for judgment. The proposition that the settlement of this question is best left to state commissions does not seem to be open for argument. The state commissions have held almost uniformly that such monopoly is better than competition. In the control through a holding company of gas plants in Philadelphia, an electric plant in New York, an electric railway in Buffalo and an electric-lighting and electric-railway system in San Francisco there is no competition. In the control similarly of twenty or of fifty plants located in separate cities of less population there is no competition.

The public utility holding company fills a useful place in the economic structure of the country, and it should not be put out of business. The basis of its revenues and growth is the local plant, which is subject to complete regulation by commissions in most states. If local plants are not under this form of regulation, they ought to be. The form of control which has proved to be so salutary where it has had effective trial should be extended to all states. The regulation of such plants is the problem and function of the several states, and it is not likely that they will surrender their rights in these respects. The states have the same power to regulate public utility plants held by holding companies that they have to regulate public utility plants held independently. If the states cannot prevent abuses in the one kind of plant, they cannot do so in the other kind. If they cannot enforce proper conditions of service, rates and capitalization in one, they cannot do so in the other, and in that case state regulation would have to be counted a failure. We believe that the best results will be obtained if the states retain control of plants within their borders with full powers of regulation to require proper practices without regard to whether properties are owned at home or abroad. If the public utility holding company cannot justify its existence under the most rigid form of state regulation it will fail and no act of Congress will save it. It should have, however, a fair opportunity to demonstrate its usefulness, and it will not receive such an opportunity unless it is exempt from the general prohibition against holding companies which appears in trust regulation bills.

The News of the Week

**Activities and Events in the Electrical Field—
Reports of Meetings—Commission Findings, Etc.**

Municipal Isolated Plant Scheme Relinquished at Springfield, Mass.

As a result of a bid by the United Electric Light Company and acting under the advice of Prof. H. E. Clifford, of Harvard University, consulting illuminating engineer of the city of Springfield, Mass., the city property committee has decided to abandon the proposed municipal isolated lighting plant for the city buildings in the urban center. The company has offered to supply energy to the municipal group at a flat rate of 4 cents per kw-hr., which will save the city $7,500 per year over the existing 7-cent rate. The 7-cent rate is to remain in force in city buildings elsewhere in Springfield. The police and fire-department headquarters, vocational school, city hall and auditorium will receive the lower rate. After a few minor alterations are made in the bid, the committee will recommend that a five-year contract be signed by the company and the board of supervisors.

Hearing on Boston Street-Lighting Contracts

At a hearing before the Boston City Council President Charles L. Edgar of the Edison Electric Illuminating Company appeared on behalf of the proposed ten-year street-lighting contract. Mr. Edgar stated that the company desired a contract of this duration on account of the large investment involved in underground and pole equipment and pointed out that no concessions in price could be made on a short-time contract. The committee on municipal affairs of the Boston Chamber of Commerce reported that the price offered—$87.53 per lamp per year—is substantially in accord with that which other cities are now required to pay for the same kind of service under similar conditions. The committee urged that both the pending gas and electric contracts should be redrafted and made more nearly uniform as regards provisions for arbitration, extensions and penalties. Mr. Edgar said that on account of local conditions comparisons of Boston prices with those in other cities are of little value. The company desires a fair price for its service and has met the city more than half way in the whole matter of contract renewal.

Electric Pleasure Vehicles Exhibit in New York

There is at present being given under the auspices of the New York Electric Vehicle Association in the new showrooms of the New York Edison Company, Irving Place and Fifteenth Street, New York, an exhibit of electric pleasure cars. Six of the leading builders have brought together in this display the finest product of their factories. Among the cars shown are an Ohio brougham, a Rauch & Lang town car, a Detroit electric runabout, a Baker brougham, a Waverley roadster, a Rauch & Lang five-passenger brougham, a Waverley brougham and a Ward coupé chassis. President Arthur Williams of the New York Electric Vehicle Association said regarding the exhibition: "It has been our endeavor to make an electric-vehicle display free from turmoil, dust, heat and other disquieting features and to conduct an exhibit of quiet elegance, in a properly ventilated and tastefully decorated hall, where one may examine the cars at leisure and without annoyance from either surrounding conditions or too attentive salesmen. The exhibit includes all that is new in electric-car designs and really indicates that gratifying progress has been made in this direction within the past year. The cars are truly suggestive of dignity, safety, comfort and cleanliness."

New England Section, N. E. L. A.

More than 200 members and guests of the New England Section of the N. E. L. A. assembled at the American House, Boston, on May 8, for the annual spring meeting of the organization, the principal speaker being Mr. Frederick P. Fish, of Boston, Mass., upon "The Present Status of Public Service Corporation Development." The speaker reviewed the development of the electrical industry from the days of small and inefficient apparatus to the present highly powerful and co-ordinated equipment, and pointed out the evils of duplication, the benefits of regulated monopoly, and the importance of the average man's and the government's encouragement of modern development along centralized lines. Mr. Fish said that it is for the best interests of the public for utility corporations to have exclusive rights in the districts covered, and that the cost of waste generally falls upon the public. The speaker held that the value of such corporations is becoming more and more appreciated by the public at large and the evils of corporate utility management have largely disappeared, resulting in better relations between the companies and their patrons. Another speaker, Mr. Thomas Wilbor, discussed conditions in Mexico.

Foreign Trade Convention at Washington

At the National Foreign Trade Convention to be held in Washington, D. C., on May 27 and 28, 1914, existing conditions in distant markets will be set forth by Hon. Cameron Forbes, ex-Governor-General of the Philippines; Mr. Edward N. Hurley, of Chicago; Mr. Welding Ring, of New York; Mr. S. D. Webb, of New York, and Mr. Alba B. Johnson, of Philadelphia. What the government is doing will be described by Mr. Wilbur J. Carr, director of the Consular Service, and Mr. A. H. Baldwin, chief of the Bureau of Foreign and Domestic Commerce. "Present Commercial Conditions in the United States, with Special Reference to Foreign Trade," will be discussed by Messrs. E. C. Simmons, James J. Hill, H. G. Herget and Robert Dollar. The effect of the Sherman law on foreign trade, the contention that large corporations are best fitted effectively to handle foreign trade, and the desirability of specifically permitting combinations of American manufacturers for foreign as distinct from domestic trade are to be the subjects of papers by Mr. J. D. Ryan,

president of the Amalgamated Copper Company. The tariff will be discussed by Prof. Henry C. Emery, of Yale. The relation of the new currency law to foreign trade, the merchant marine, ocean transportation, and government assistance in foreign trade are other topics on the program.

The convention will be held under the auspices of the American Manufacturers' Export Association, the American Asiatic Association, and the Pan-American Society, and will be opened by Secretary Redfield of the Department of Commerce. The chairman of the general committee on arrangements is Hon. Lloyd C. Griscom, ex-American Minister to Japan and Ambassador to Italy. The official headquarters of the committee are in the Manhattan Life Building, 66 Broadway, New York.

A. I. E. E. Business Meeting

At the annual business meeting of the American Institute of Electrical Engineers, held on May 12, announcement was made of the result of the election of officers. The directors' nominees, listed on page 684 of our issue dated March 28, 1914, were elected. Including the newly elected members, the officers of the Institute for the year beginning Aug. 1, 1914, will be as follows:

President, Prof. Paul M. Lincoln; vice-presidents, Messrs. H. H. Barnes, F. S. Hunting, J. A. Lighthipe, Farley Osgood, C. F. Scribner and N. W. Storer; managers, Messrs. Comfort A. Adams, Frederick Bedell, B. A. Behrend, J. H. Finney, Bancroft Gherardi, William B. Jackson, Peter Junkersfeld, H. A. Lardner, A. S. McAllister, William McClellan, Lewis T. Robinson and H. Franklin Stevens; treasurer, Mr. George A. Hamilton; secretary, Mr. F. L. Hutchinson.

According to the report of the board of directors, the membership on April 30, 1914, consisted of five honorary members, 439 fellows, 1027 members and 6405 associates; total, 7876, a net increase of 222 since April 30, 1913.

Following the business meeting a technical session was held under the auspices of the committee on the use of electricity in marine work. Lieut. C. S. McDowell, of the United States Navy, chairman of the committee, acted as chairman of the session. Two papers were presented by the authors, as follows: "Electricity, the Future Power for Steering Vessels," by Mr. H. L. Hibbard, and "The Future of Electric Heating and Cooking in Marine Service," by Mr. H. J. Mauger. These papers were discussed by Messrs. G. Pierce, M. Pfatischer, W. J. Day and W. S. Hadaway, Jr. Abstracts of the papers will appear in a later issue.

Ohio Utilities Committees Organize

The two special committees recently appointed by the Ohio Electric Light Association to assist the central-station interests of the State in making valuations and appraisals in obedience to an order of the Ohio Public Utilities Commission, as noted in the *Electrical World* for May 9, 1914, met at the Hotel Chittenden, Columbus, Ohio, on May 15 to elect chairmen and adopt plans for work. Mr. Robert Lindsay, vice-president and general manager of the Cleveland Electric Illuminating Company, was elected chairman of the committee on appraisal. The other members of this committee are Messrs. F. M. Tait, Dayton; M. F. Millikan, American Gas & Electric Company, New York; F. J. Derge, Toledo, and W. W. Freeman, Cincinnati.

Mr. L. K. Funkhouser, secretary and treasurer of the Dayton Power & Light Company, was elected chairman of the committee on uniform accounting. The other members of this committee are Messrs. J. H. Scobell, Cleveland; T. F. Wickham, Cincinnati; F. B. Lasher, Republic Railway & Light Company, New York, and F. W. Drager, American Gas & Electric Company, New York.

Both committees were to meet again at Cleveland on May 22, at which time they were to make reports and present forms and schedules on a standard type on which the returns from the central stations of the State can be made. It was understood that at this time the suggested forms and schedules would be submitted to Mr. Nau, expert accountant for the Ohio Public Utilities Commission, for his approval. By thus co-operating with the State authorities it is hoped that the order of the commission, which requires valuations as of July 1 to be filed by Aug. 1, may be obeyed with the minimum of expense and effort on the part of the central stations. In this way it is hoped to make the returns in a standard form which will be acceptable to the commission. It is also understood that a small tax has been assessed upon the central-station interests of the entire State to provide funds for the work of the two committees.

Entertainment Features of the N. E. L. A. Convention

The program of entertainment arranged for the convention of the National Electric Light Association to be held at the Bellevue-Stratford Hotel, Philadelphia, Pa., June 1-5, has been given out by Mr. W. C. L. Eglin, vice-president of the Philadelphia Electric Company and chairman of the general convention committee. During the afternoon of June 1 a preliminary baseball game for the Westinghouse trophy will be played at the Franklin field between the Philadelphia and Baltimore teams.

The usual reception to the President and officers of the association will be given on the evening of June 1 in the ballroom of the Bellevue-Stratford Hotel. On the morning of June 2 visits will be made to municipal points of interest and the larger department stores. The new home of the Curtis Publishing Company, in Independence Square, will be open for inspection to the ladies, and a special recital will be given during the morning on the pipe organ in the Grand Court at Wanamaker's.

On the afternoon of June 2 a musical has been arranged for the ladies in the assembly room of the Manufacturers' Club. The entire convention will make an excursion to Willow Grove Park on Tuesday evening. Special trains will leave the Reading Terminal for the park, which is considered one of the finest amusement resorts in the world. The electrical decorations are most attractive, and there will be a special exhibition of the electric fountain. The entire seating capacity for the band concert has been reserved for that night. A rejuvenation of the Sons of Jove will also take place in Willow Grove on Tuesday night.

Wednesday, June 3, has been called "university day." During the morning an automobile trip through Fairmount Park has been proposed for the ladies, and during the afternoon the annual championship baseball game will take place at the Franklin Field of the University of Pennsylvania. Provost Edgar F. Smith of the university has extended the privileges of the Houston Club, the swimming pool and the gymnasium to all the delegates. Before the baseball game a tour of inspection will be made of the University of Pennsylvania buildings, concluding with a reception by Provost Edgar

F. Smith. The public policy meeting is scheduled for Wednesday evening, June 3, and card parties have also been arranged for the ladies, the prizes consisting of electrical appliances.

A river excursion is scheduled for the morning of June 4 for the ladies, a visit being planned to the League Island Navy Yard. Luncheon will be served on board the steamer. All the great shipbuilding industries and other points of interest on the Delaware River front will be passed on the sail. Orchestral concerts will be provided throughout the trip. On Thursday evening a dance will be given in the ballroom of the Bellevue-Stratford Hotel. There will be an exhibition of modern dances together with music and singing.

Mr. H. A. Wagner, of the Consolidated Gas, Electric Light & Power Company, of Baltimore, has extended an invitation to the delegates to visit the hydroelectric development of the Pennsylvania Water & Power Company at Holtwood (McCall's Ferry), on the Susquehanna River. If a sufficient number express a desire to visit the plant, a special train will be provided, leaving the Broad Street station of the Pennsylvania Railroad about 1 o'clock in the afternoon and returning about 8 o'clock in the evening. The trip requires about two hours each way, and luncheon will be served en route.

Program of the District Heating Associafion

A wide and important range of subjects will be considered at the sixth annual convention of the National District Heating Association, to be held at Rochester, N. Y., from May 26 to 29.

Among the reports to be presented are the following: Underground construction committee, Mr. H. A. Woodworth, Indianapolis, chairman; nominating committee; meter committee, Mr. A. D. Spencer, Detroit, Mich., chairman; record committee, Mr. A. P. Biggs, Detroit, Mich., chairman; rate committee, Mr. E. L. Wilder, Rochester, N. Y., chairman; educational committee, Mr. D. S. Boyden, chairman, and station-operating committee, Mr. B. T. Gifford, Grand Rapids, Mich., chairman.

The papers will include the following: "Public Policy of Utilities," by Mr. R. M. Searle, Rochester, N. Y.; "Manufacture of Welded Iron and Steel Pipe" (accompanied by moving pictures showing the progress of manufacture), by Mr. D. R. Mason, Pittsburgh, Pa.; "Use of Bleeder Turbines in Connection with Steam Heating," by Mr. R. D. DeWolf, Rochester, N. Y.; "Hot-Water Heating Under Forced Circulation," by Mr. Thomas Donahue, Lafayette, Ind.; "Expense of Operating Centrifugal Pumps Versus Double-Acting Pumps," by Mr. A. C. Rogers, Toledo, Ohio; "Some Effects of Utility Regulation as Affecting District Heating," by Messrs. H. Almert, Chicago, and D. L. Gaskill, Greenville, Ohio; "Effect of Superheated Steam on Heating Systems," by Mr. D. S. Boyden, Boston; "District Heating for Small Towns and Cities of 10,000 Population and Under," by Mr. L. T. Mason, Hornell, N. Y.; "Heat Losses from Buildings of Latest Construction," by Mr. J. Byers Holbrook, New York City; "Which Is More Profitable: To Shut Off Steam at Night or Keep It on Continuously?" by Mr. E. L. Wilder, Rochester, N. Y.; "Economic Advantages to Consumers of Central-Station Heating Service Over Individual Heating Plants," by Messrs. N. M. Argabrite and Thomas F. English, Muncie, Ind.; "Customers' Steam-Heating Systems," by Mr. H. R. Wetherell, Peoria, Ill., and "Commercial Steam Heating in New York City," by Mr. George W. Martin, New York City.

An attractive program of entertainment has been arranged for the visiting ladies. The headquarters, meeting place and exhibit of the convention will be at the Seneca Hotel.

Michigan Section, N. E. L. A.

The plans for the convention of the Michigan Section of the National Electric Light Association, which will be held on the steamer *Rochester*, June 17-20, are rapidly assuming shape. The following papers and addresses have already been arranged for: "Regulation of Public Utilities and Returns Allowed Thereunder," by Mr. Halford Erickson, Wisconsin Railroad Commission; "Water-Power in Michigan," by Mr. G. W. Bissell, of the Michigan Agricultural College; "The Gas-Filled Lamp," by Mr. J. R. Colville, of the National Lamp Works of the General Electric Company; "Interior Illumination," by Mr. M. Luckiesh, of the National Lamp Works; "Outdoor Substations," by Mr. A. Meyer, of the Edison Illuminating Company, Detroit; "Description of Automatic Substations," by Mr. James W. Bishop, of the Edison Illuminating Company, Detroit; "Depreciation and Obsolescence," by Mr. H. A. Fee, Adrian, Mich. An address will be made by Mr. J. B. Oxtoby, of Detroit.

The meetings will be held on board the boat at night, and an endeavor will be made to have most of the papers illustrated by lantern slides. In conformity with a resolution passed by the executive committee early in the year, the reading of papers by abstract will be inaugurated. A rejuvenation of the Jovian Order will also be held on board the boat.

The itinerary calls for a departure from Detroit on the evening of June 17 for Buffalo, which will be reached the next morning. The delegates will then visit Niagara Falls, and at the invitation of Mr. Philip P. Barton will inspect the American and Canadian plants of the Niagara Falls Power Company. The boat will leave Youngstown on June 18, passing up the St. Lawrence through the Thousand Islands, arriving at Ogdensburg on June 19. The return trip will begin on June 19, the delegates arriving at Toronto on June 20, where they will board a special train on the Canadian Pacific Railway for Detroit.

Wakefield, Mass., Changes from Municipal to Central-Station Service

Wakefield's municipal light commission has just signed for the town a contract with the Edison Electric Illuminating Company of Boston whereby the latter will furnish all the electric service the town will use. This will include street lighting and all electricity for commercial and domestic purposes.

Wakefield has been operating, under the supervision of its commission, the town's electric generating plant to furnish the service from dark until daylight and has taken such additional service as has been needed for daytime use from the Reading municipal plant. The commission some time ago began investigating the possibilities of securing service from the generating and distribution system of the Boston Edison company and after a careful study of all the conditions has decided to shut down the town's own old plant, discontinue using the Reading municipal service and take the Boston Edison service. The change will be made as soon as the Boston Edison company can extend its lines to the town, which will be done in a comparatively short time. The latter company will furnish 2300-4000-volt, four-wire, sixty-cycle alternating-current service from which

either single-phase for lighting or three-phase for motor purposes can be delivered as desired. The lines will be run in duplicate in order to insure the extra protection of the town.

The change from the use of a municipal generating station of limited output to the efficient, economical service of a public service corporation with practically unlimited output, which may mean much in the development of Wakefield's manufacturing business, has been made without any increase of the town's financial obligations or investment in property and machinery.

Purchased Energy for Electric Railways

Mr. Peter Junkersfeld, assistant to the vice-president of the Commonwealth Edison Company, gave an illustrated address on "Power Production for Electric Railways" at the meeting of the Illinois Electric Railways Association in Chicago on May 15. Mr. Junkersfeld pointed out that in 1902, according to the United States Census Bureau, the amount of electrical energy purchased by electric-railway companies was negligible. Ten years later the government's figures showed that 33 per cent of all the electrical energy used by the electric railways of the United States was purchased. In Illinois in 1912 the proportion of purchased electricity for railway operation was 58 per cent, while in Chicago during the first four months of the present year the amount of purchased electrical energy for the operation of surface and elevated railways was 90 per cent.

Economic reasons, of course, account for this development. The electric-service company specializes in the production of electrical energy, and by serving the diverse wants of the community and by utilizing the most economical apparatus in large units it is often able to sell electricity for the operation of electric railways cheaper than the electric-railway companies can manufacture it. Assuming an average load-factor of 40 per cent, the rate at which electrical energy is furnished by the Commonwealth Edison Company to the railways of Chicago works out a little over 0.7 cent per kw-hr. The amount paid by the Chicago electric railways for purchased energy in 1913 was in round numbers $3,750,000. The cost per kilowatt-hour has so far shown a constant tendency to decrease. During the last six years electric-railway power houses with a total rating of about 80,000 kw have been shut down in Chicago, owing to the fact that their owners purchase electrical energy from the electric-service company.

Another point of interest to electric-railway operating men is the fact that by purchasing electricity in a large city from a large central organization it is possible to increase the number of feeding points available for both surface and electric-railway operation. Mr. Junkersfeld exhibited a number of curves, one showing how the investment and operating costs are much less for the railway customers than for the average lighting and motor customers, thus indicating how it is possible to sell the energy purchased wholesale for railway operation at such a low rate. A curve of annual load-factors showed that as the output per capita increases the load-factor improves and the income and cost per kilowatt-hour decrease. Another diagram gave a graphic illustration of the manner in which the diversity-factor enters into the economical production of central-station energy.

In the afternoon the railway men were taken on a trip of inspection through the Fisk Street and Quarry Street generating stations of the Commonwealth Edison Company.

Record Year for Westinghouse Electric & Manufacturing Company

The Westinghouse Electric & Manufacturing Company reported Wednesday a gross business in the fiscal year ended on March 31 of $43,733,646, a total far surpassing the record of any other year of the company's history. The turnover was $3,756,081 larger than in 1913, which was the next best period for sales. Expenses absorbed $39,016,424, an increase of $3,610,131, and net income of $4,717,222 was considerably smaller than in 1911, but $145,950 greater than in 1913. After paying interest charges on bonds, etc., a balance of $4,058,809 was left for dividends and other purposes, as against $3,164,032 last year.

Mr. Guy E. Tripp, chairman of the board of directors, told shareholders in the annual statement that orders were fewer at the end of the year than at the beginning. "The value of unfilled orders on March 31, 1813," said he, "was $12,061,473; on March 31, 1914, the value of unfilled orders was $7,951,385. The average number of employees during the year was 18,635, as compared with an average of 20,542 for the previous year. A net decrease in the total investments in foreign companies is chiefly accounted for by the depreciation of $1,000,000 in the book value of the debentures of the Russian company. The liquidation of this company has proceeded most satisfactorily, and during the year remittances aggregating over $900,000 were received by the company in reduction of the amount due for advances made. It is expected that the liquidation will be completed during the current fiscal year. The reports of the British Westinghouse Electric & Manufacturing Company, Ltd., for the year ended Dec. 31, 1913, reflect a continued improvement in the affairs of that company. The affairs of the French company again show improvement during 1913. Its net income exceeded that of any previous year in its history. The Italian company has received additional orders for locomotives from the Italian government beyond those referred to in last year's report and it now has orders in hand sufficient fully to occupy its facilities during the current year. The total liabilities of the company show a decrease of over $5,000,000 as compared with the previous year. The funded debt shows a decrease of over $500,000, due to the payment of the outstanding balance of debenture certificates due July 1, 1913, and the sinking fund payment." The gross surplus was $12,002,305, and total surplus was given in the report as $7,659,130 as of March 31, 1914. The balance sheet showed aggregate assets valued at $82,672,240, of which more than $6,000,000 was in cash.

Mr. Cravath on "Brightness"

At the regular meeting of the Chicago Section of the Illuminating Engineering Society on May 13 Mr. W. A. Durgin opened the meeting with the fourth and last of a series of twenty-minute talks on "Fundamentals of Illumination." Taking up the characteristics of light sources, Mr. Durgin performed some interesting experiments with various types of incandescent and arc-lamp sources to show how the light given off from each of these differed from the others. The feature of the demonstration was the experiment which showed the whiteness of the light from the tungsten filament operated at double normal voltage and giving a light similar to that of the new high-efficiency tungsten lamp.

Reading a paper entitled "Brightness," Mr. J. R. Cravath, consulting engineer, Chicago, gave a statement of the elementary principles involved in calcula-

tion and measurement of surface brightness, at the same time demonstrating the use of the new small-type Sharp-Millar photometer. In an extensive table compiled from personal observations and such other authorities as Ives and Luckiesh, Bell ("Art of Illumination") and the American Luxfer Prism Company, Mr. Cravath presented data showing the enormous difference in brightness within the field of view to which the eye is subjected. Taking, for example, a small room illuminated by a clear tungsten incandescent lamp, the filament presents a brightness of 1060 cp per sq. in., while the walls of the room may easily show as low as 0.00015, giving a ratio of about 7,000,000 to 1. From the data in this table it was concluded that the contrasts or differences of brightness within the field of vision with the undiffused light of modern artificial illuminants are much greater than those to which ordinarily the eye is similarly exposed for considerable periods with natural light. It was concluded further that indirect artificial lighting is being commonly carried out with differences of brightness in the field of view approximating northern-exposure daylight. The distribution of brightness, however, within the field of vision in the two cases is different. A set of experiments conducted by the speaker showed why indelible-pencil marks become invisible under certain light conditions. Carrying these tests further, Mr. Cravath showed that upon white bond paper blue ink, black-pencil and indelible-pencil marks are respectively least objectionable from the standpoint of glare. Commenting upon these tests, the speaker said in conclusion that writing and printing do not present such marked contrasts with the paper as is popularly supposed.

At the next meeting, on June 10, a paper on Chicago street and subway lighting will be read by Mr. P. E. Haynes, of the city electrical department, and Prof. A. H. Ford, Iowa City, will speak on the design of electric signs.

Patent Office Salaries

A bill was introduced in the House of Representatives on May 12 by Representative Oldfield. Its purpose is to improve the efficiency of the Patent Office. The bill was referred to the committee on patents. Representative Oldfield expresses confidence that the bill will be reported out of committee in practically its present form, and that it will be passed by this Congress, although probably not at this session.

The position of first assistant commissioner of patents would be created if the bill becomes a law. There would be five examiners in chief, instead of three as at present. The salary proposed in the bill for the first assistant commissioner of patents is $4,500. The salaries of the examiners-in-chief would be raised from $3,000 to $3,500. The positions of commissioner, first assistant commissioner, assistant commissioner and examiners-in-chief would be filled by Presidential appointment.

The bill proposes to raise the salary of the Commissioner of Patents from $4,500 to $5,000 a year. To the salary of the assistant commissioner of patents $500 would be added, making it $3,500 a year.

Positions in the examining force created by the bill are: Five law examiners, at $2,750 a year; one examiner of classification, at $3,600 a year; twenty-one additional principal examiners, with salaries of all forty-three examiners advanced from $2,500 to $2,700; sixty-two additional first assistant examiners, with the salaries of the entire eighty-six who may hold these posts advanced from $1,800 to $2,400; sixty-two additional second assistant examiners, with the entire force of eighty-six who would hold these positions increased from a salary of $1,600 to $2,100 a year; sixty-two additional third assistant examiners, increasing the force to eighty-six, with advance in salary from $1,400 to $1,800; eighty-six fourth assistant examiners, a new position created by the bill, at a salary of $1,500, and four draftsmen at $1,000 a year salary.

The salary of the chief clerk would be increased from $2,500 to $3,000 a year. The language of the bill provides that the chief clerk shall be qualified to act as principal examiner.

Other increases in salary which the bill would provide are: From $2,500 to $2,700 for the examiner in charge of interferences, and from $2,500 to $2,700 for the examiner in charge of trade-marks. Salaries of the librarian at $2,000 a year and one messenger and property clerk at $1,000 a year would remain unchanged. The former title of "messenger and purchasing clerk" would be changed to "messenger and property clerk."

Positions that the bill would abolish are: One machinist at $1,600 a year; thirty-five copyists of drawings at $1,000 a year; one skilled laborer at $1,200; eight attendants in the model room at $1,000, and eight attendants in the model room at $900 a year.

Meeting of Philadelphia Engineers and Scientists

More than 400 members of scientific and engineering societies of Philadelphia attended the get-together meeting held in that city on May 15. Prof. George A. Hoadley, of Swarthmore College, who acted as chairman of this, the first meeting of its kind in Philadelphia, stated that the committee in charge had obtained a complete list of names and addresses of the members of the scientific and engineering societies of Philadelphia, the total without duplicates being in excess of 4000.

Director George W. Norris of the Department of Wharves, Docks and Ferries, Philadelphia, outlined the extent to which civic problems have become engineering in nature and require the services of engineers for solution. Dr. W. W. Keen, president of the American Philosophical Society, showed that the great advances in civilization have been directly attributable to the discoveries of the scientists and the inventions and developments made by the engineers. Dr. Walton Clark, president of the Franklin Institute, described the work accomplished and being carried forward by the Institute directly for the benefit of scientists and engineers and indirectly for the benefit of all humanity.

Dr. Alexander C. Humphreys, president of Stevens Institute of Technology, delivered an address on "The Engineer as a Factor in Modern Progress." He criticised engineers for not taking a more active interest in public affairs. He claimed that commissioners for regulating public utilities should be selected from men familiar with the problems of the utilities and not from incompetent persons looking for jobs. The country suffers from the destructive criticism of persons incapable of improving the conditions but anxious to attempt to do so for the pay thereby to be obtained. Legislators are attempting to destroy the business which has become big by reason of the very laws which the politician-legislators have brought into existence. If present business is bad, the remedy is to be found in doing away with the politicians rather than in placing uneconomical fetters on big business. Dr. Humphreys predicted that conditions will be worse before they become better. He urged engineers, and especially those having had the opportunity of college train-

ing, to become active in public affairs, wherein their knowledge will prove of immense benefit in the solution of the great problems now confronting the nation.

Dr. C. P. Steinmetz and President James M. Dodge of the American Society of Mechanical Engineers were unable to be present to deliver their addresses on "Electricity in Modern Industry" and "Engineering Societies."

In addition to Prof. Hoadley, the committee in charge of the arrangements for the meeting consisted of Messrs. L. B. Eichengreen, Joseph D. Israel, H. A. Hornor, R. B. Owens, C. C. Tutwiler and J. A. Vogelson. It is expected that similar meetings will be held at convenient intervals in the future.

Convention of Oklahoma Electric Association

The fourth annual convention of the Gas, Electric and Street Railway Association of Oklahoma was held at Oklahoma City May 13 to 15 inclusive, with an attendance numbering nearly 100. Col. J. W. Johnson welcomed the delegates on behalf of the city, and the president of the association, Mr. F. E. Bowman, Ada, responded with an appropriate address in which he urged upon utility managements their duty to dispense "moral light" in their communities twenty-four hours a day, no less than to dispense physical light during the hours of darkness. Despite the general advancing cost of living, said President Bowman, the price of electric-lighting service has steadily decreased, while for a 5-cent fare the street-car passenger now enjoys a longer, swifter and safer ride than ever before. Many of the Oklahoma electric plants, he pointed out, were built in advance of their communities, although with prophetic vision and implicit confidence in the ultimate development of the local townsite. Such pioneer utilities, he declared, have been great factors in the rapid growth of the new State. The public, concluded Mr. Bowman, should be informed of this important service to the commonwealth, among others, and should be educated to a realization that the Oklahoma utilities intend to give to all "the best of service and a square deal."

Grounding of Secondaries

In the absence of Mr. Burton French, engineer for the Public Service Company of Oklahoma, Mr. Galen Crow, Guthrie, read the author's paper on "The Grounding of Secondaries." Mr. French especially recommended that the smaller plants follow the practice of grounding secondaries already universally adopted by the larger companies, since it is in the smaller towns that the majority of accidents occur. In some parts of Oklahoma the quality of the soil makes grounding difficult and expensive. The water mains would, of course, furnish a good ground connection, but these pipes are not always available nor will permission for their use be always granted by the authorities, although it has been repeatedly shown that no possible electrolytic damage can be done by such an alternating-current ground connection. A ground-wire system with frequent ground plates may also be employed. For use under ordinary soil conditions Mr. French described the galvanized-pipe, charcoal-cone, copper-plate and wire-coil methods of grounding, recommending for general use the galvanized-iron-pipe ground.

Mr. J. M. Brown, of Oklahoma City, told of the difficulties of obtaining safe grounds locally with either pipes or grounded cones. After having proceeded half way with the grounding of the local system, reports of poles on fire, smoking sidewalks, electrified buildings, etc., began to come in at such a rate that construction was stopped and many grounds already in were at once removed as constituting hazards. Tests then made showed the poor character of the "grounds" after the soil had become dry. The Oklahoma water-supply authorities have refused formal permission to have ground connections made to the water pipes.

Mr. Lincoln Beerbower, Enid, described his practice of grounding all secondaries by the galvanized-pipe method, which he said was both easy to install and satisfactory in service. Messrs. Galen Crow, W. M. Dunn, Holdenville, and F. W. Insull, Oklahoma City, also spoke briefly.

Electric Drive in Shops and Factories

Prof. A. P. Little, Oklahoma Agricultural and Mechanical College, Stillwater, Okla., followed with a paper on "Electric Drive in Shops and Factories as a Means of Increasing the Central-Station Day Load." The author described special applications of various types of motors in order to take advantage of their torque characteristics and gave figures for the ratings required to drive wood-mill machinery, printing presses, etc.

Mr. Galen Crow, Guthrie, remarked that most operators of small private plants verily believe they are producing energy more cheaply than it can be purchased from a central station, although this is invariably self-delusion.

In comparing the cost of oil and coal as fuels, Mr. F. W. Insull, Oklahoma City, cited an instance in which firing with coal at $2.25 per ton was found to be 25 per cent cheaper than burning oil at $1 a barrel. Mr. W. Tritle, Kansas City, Mo., compared oil at $1 per barrel with coal at $2.25 per ton. Mr. W. J. Dibbins, Guthrie, reported that economy resulted from replacing coal at $2 with 10-cent gas.

Messrs. P. L. Lewis, Dallas, Tex.; G. W. Knox, Oklahoma City; H. V. Bozell, Norman; L. D. Means, Hobart, and F. E. Bowman, Ada, also took part in the discussion, advancing arguments for replacing private plants by motor drive.

At the session of Thursday morning Mr. R. H. Lyon, the Holophane Company, Dallas, Tex., gave a talk on and demonstration of the scientific use of glassware in illumination. Mr. C. H. Talmage, Western Electric Company, Kansas City, Mo., followed with an illustrated paper on methods of pole manufacture and preservative treatment, which he illustrated with lantern slides.

Franchises, Rates and Revenues

The Thursday afternoon meeting was held in the engineering building of the University of Oklahoma, Norman. A paper advocating the adoption of the "indeterminate permit" in Oklahoma and pointing out the unfairness of omitting municipal plants from commission supervision was presented by Mr. W. J. Norton, Norton & Bird, engineers, Chicago, and was read in the author's absence by Mr. F. W. Insull. Mr. Norton gave a number of arguments and cited many precedents to show the advantages of indeterminate franchises over term franchises. The subject of his paper and the proposal to subject municipal plants to commission regulation provoked a lively debate. Those who took part were Messrs. Bozell, Insull, Knox, Dibbins, John A. Williams, Shawnee; H. S. Cooper, Weatherford; W. M. Dunn, Holdenville; W. J. Mathias, Frederick; N. R. Gasho, Alva; T. Miller, Oklahoma City, and W. E. Blackwell, Afton.

Prof. L. W. Morrow, of the electrical engineering department of the State University, followed with his paper on Oklahoma rates and revenues, representing a careful compilation, from the files of the corporation commissions and other sources, of the finances, incomes, expenses, costs, etc., of the privately owned electric and

gas properties of the State, as well as of a few municipal plants from which replies were received.

An Explanation of Order No. 774

On Friday morning the Hon. A. P. Watson, member of the Oklahoma Corporation Commission, spoke on the subject of original cost as a factor in the regulation of gas and electric utilities. The commissioner sought to justify the now famous commission order No. 774, which requires all gas and electrical utilities to file with the commission complete and detailed drawings of all their properties, plants and buildings. The purpose of the commission in this, he explained, is to establish a basis for the proper valuation and rate regulation of utilities, a measure for their own protection as well as for that of the public. This ruling, he predicted, will ultimately earn the gratitude of all the utility operators in the State, including even the small-plant men, who are now the chief objectors.

In the brief discussion which followed President Bowman and Mr. Knox expressed their approval of the commission's attitude. In reply to a query from Mr. Cooper, Commissioner Watson said that in those cases where the commission has found evidences of poor plant management and unwarranted expense it could not order a reduction of rates on the basis of what some plant in a nearby community was doing, although the commissioners have not hesitated in such cases to advise the owners to procure capable operators.

Problems in Dealing with the Public

The "Handling of Complaints" was the subject of Mr. George B. Saunders' paper. In this he described the classes of occasional and chronic "kickers" encountered by a public-service company, and he recounted his own methods of meeting complainants and winning their confidence and friendship. "Of all the crimes with which public-service corporations have been charged," quoted Mr. Saunders, "the greatest is the one they have committed against themselves—the crime of non-publicity."

Mr. F. J. Meyer, Oklahoma City, discussed methods for preventing tampering with meters and theft of energy. Where evidence of theft can be secured Mr. Meyer recommended assessing the culprit a liberal estimate of the energy fraudulently taken, finally offering to drop the case if restitution is made promptly. This method, he said, often proves to be more remunerative to the company than a prosecution would be.

Election of Officers

The official report of Secretary H. V. Bozell, Norman, was followed by a general hearty tribute to the value of his services to the association. The committee on resolutions, Messrs. Beerbower, Morrow and Means, then presented its report. The electoral ticket proposed by the nominating committee—Messrs. Gasho, Insull and Carey—was next unanimously approved and the following officers elected for the year: President, Mr. George W. Knox, Oklahoma City; vice-presidents, Mr. W. J. Dibbins, Guthrie, and H. S. Cooper, Weatherford; secretary-treasurer, Prof. H. V. Bozell, Norman; directors (in addition to the above officers), Messrs. Lincoln Beerbower, Enid; C. S. Dawley, Okmulgee, and W. R. Molinard, Oklahoma City. Committees with chairmen were appointed as follows: Public policy, Mr. F. W. Insull, of Oklahoma City; membership, Mr. Thomas Carey, of Norman; accounting, Mr. H. Willmering of Oklahoma City; public safety, Mr. J. J. Johnson, of Oklahoma City; relations with customers, Mr. F. H. Tidman, of El Reno; fuel efficiency, Mr. A. P. Little, of Stillwater, and entertainment, Mr. F. J. Meyer, of Oklahoma City.

Mr. George W. Knox, president-elect of the Gas, Electric and Street Railway Association of Oklahoma, is vice-president and general manager of the Oklahoma Railway Company, which operates the street and interurban electric railways of Oklahoma City and vicinity. He is also president of the Knox-Heskett Engineering Company, Chicago, and is largely interested in the Chisholm (Minn.) Electric Lighting Company, of which he is a director. Mr. Knox has had a long and varied experience in the electric railway and lighting fields, dating from the pioneer days of the later eighties. On his graduation from the Northern Illinois College in 1885 he first engaged in steam-railroad work, but in 1887 he was employed by the old Thomson-Houston company to install the street-car system at Omaha, Neb. Two years later he joined the staff of the Sprague Electric Company, Chicago, but in 1891 his services were engaged by the Edison General Electric Company and for the latter he carried out the complete electrification of the Milwaukee horse-car lines. In 1892 he converted the Dubuque (Ia.) battery-driven street-car system to overhead trolley. Returning to Chicago, he next superintended the electrification of the 160 miles of track of the Chicago City Railway Company, and then continued as electrical and construction engineer

PRESIDENT-ELECT GEORGE W. KNOX

of the company until 1899. In 1901 he organized the Knox Engineering Company at Chicago, the name of which has been since altered to the form noted above. Among the executive positions which Mr. Knox has held in the electric-railway and lighting fields are those of president of the Choctaw Railway & Light Company, McAlester, Okla., and general manager of the Freeport (Ill.) Railway & Light Company. Mr. Knox in 1901 made the original study and report on the Oklahoma electric-railway situation which resulted in the construction of the present modern system. He first acted as consulting engineer during the construction period, but in July, 1911, transferred his headquarters to Oklahoma City, becoming vice-president and general manager of the system. Mr. Knox is a member of the American Institute of Electrical Engineers and of the American Electric Railway Association. During 1913 he served on the latter's committee on power generation, and this year he is on its committee on taxation.

Among the entertainment features of the convention was a banquet Thursday evening, over which Mr. Galen Crow presided as toastmaster. Addresses were made by Prof. Jerome Dowd, of the University of Oklahoma; Mr. E. C. Patten, attorney for the corporation commission; Mr. F. W. Insull, and others.

Public Service Commission News

Illinois Commission

The Public Utilities Commission of Illinois has now in course of preparation rules fixing standards for gas and electrical service. Representatives of the commission are having conferences with committees of the electric-light and gas associations of the State and with engineers of different companies. It is expected that within five or six weeks the commission will have an open hearing at which all companies will be asked to be represented. It is probable that the rules when finally adopted will follow very largely those adopted by the other state commissions.

Wisconsin Commission

The Chippewa Valley Railway, Light & Power Company has been authorized to issue $6,000 in preferred stock to be exchanged for the property of the Inter-County Light & Power Company, of Elmwood.

The Bark River Electric Light & Power Company has been authorized to issue $12,000 in stock, part of which is to be exchanged for stock illegally issued and the rest is to be used for new construction.

The Coleman-Pound Light & Power Company has been granted permission to issue $6,000 in stock to apply on the construction of an electric-light plant to supply the villages of Coleman and Pound.

Pennsylvania Commission

The Public Service Commission of Pennsylvania has issued general orders Nos. 8 and 9, giving instructions as to the matters of filing tariffs with the commission and of issuing rates on less than statutory notice. Companies subject to the law are required to file with the commission not later than June 1, 1914, all tariffs issued which were in effect on Jan. 1, 1914, together with the amendments or re-issues. The companies are also to file rules and regulations that in any manner affect the rates or facilities.

Indiana Commission

The commission has entered an order requiring all of the utility companies in Indiana to file by Sept. 1 of this year complete inventories of their property "used and useful for the convenience of the public." The commission has already valued a number of the larger utility plants of the State and others have filed appraisals made by experts hired by the individual companies. Still other concerns have filed inventories. All of the foregoing are exempt from the operation of the new order.

New York Commissions

The Public Service Commission for the First District has decided to reopen the rate case of the Kings County Lighting Company, which was decided recently by the Court of Appeals. A resolution was adopted calling for a further hearing, beginning May 7, 1914, before Commissioner Milo R. Maltbie. This case was decided by the commission last year, when an order was passed directing the company, which serves the Coney Island district of Brooklyn, to reduce the price of gas to 95 cents per 1000 cu. ft. The company took the matter into the courts. The Appellate Division in May, 1913, decided the case adversely to the commission, which appealed to the Court of Appeals. The Appellate Division's opinion sustained the commission's action except in respect to going value, paving over mains and treatment of the annual increase in land value as part of income. The Court of Appeals, while agreeing with the Appellate Division as to going value and annual increase in land, disagreed with it and sustained the commission in regard to paving over mains. It also greatly enlarged the Appellate Division's opinion as to the nature of going value.

Current News Notes

TO DISCOURAGE JOB-SEEKING ALDERMEN.—Alderman Charles E. Merriam has reintroduced into the City Council of Chicago his amendment to the rules intended to prohibit aldermen from importuning public service corporations operating in Chicago to give employment to themselves "or any other persons." The resolution was sent to the judiciary committee.

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TORONTO COMPANY WINS POLE CASE.—Through an opinion handed down last week by Judge Middleton, the Toronto (Ont.) Electric Light Company obtained an injunction against the city of Toronto, which sought to remove the company's poles from Playter Boulevard, Ellerbeck Avenue and adjacent streets. The court held that the company may erect poles and string wires on any street or highway within any part of the existing or future limits of the city.

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SUMMER COURSES AT UNIVERSITY OF WISCONSIN.—Announcement is made of the fourteenth annual six weeks' summer school of the College of Engineering of the University of Wisconsin, which opens on June 22. Courses of instruction and laboratory practice are offered in electrical, hydraulic, steam and gas engineering, mechanical drawing, applied mechanics, testing of materials, machine design, shopwork and surveying, in addition to which subjects may be taken in the College of Letters and Science.

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CHICAGO JOVIAN LEAGUE.—In order to make its organization locally self-sustaining the Chicago Jovian League is considering a plan by which membership dues at $2 a year will be paid by those who subscribe to the plan. In addition it has been suggested that a class of sustaining members be provided, such members to agree to contribute annually such proportion of a certain pledged sum as may be required. Another suggestion is that provision be made for non-Jovian members of the Chicago Jovian League, such members to pay $2 a year, with the understanding that their membership is for one year only.

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PINK SPECIAL FROM PITTSBURGH FOR N. E. L. A. CONVENTION.—The transportation committee of the National Electric Light Association announces another special train leaving Pittsburgh in the morning of Sunday, May 31, and making a daylight run to Philadelphia. This train will carry passengers from St. Louis, Cincinnati, Columbus and other points centering in Pittsburgh in the early morning of May 31, and these, in connection with the large Pittsburgh contingent, will make up the special train, which will be known as the "pink special" and will be under the personal direction of Mr. J. C. McQuiston, of East Pittsburgh, Pa.

* * *

ENERGY USED FOR CHARGING VEHICLES IN NEW YORK.—In connection with the published statement of the revenues of the New York Edison Company which appeared on page 1033 of the *Electrical World* of May 9, an explanation has been made by Mr. Arthur Williams of the classifications "charging vehicles" and "storage battery." The revenues indicated of these classifications in the May 9 issue show only the amount of energy sold by the New York Edison Company under its special automobile and storage-battery-charging schedule, the rest of the energy sold for battery-charging purposes being included under "commercial metered power." According to Mr. Williams, the total output of the New York Edison Company for electric-vehicle charging is in the neighborhood of 7,000,000 kw-hr. a year.

Reprint of Wisconsin Electrical Association Papers.—Papers presented at the annual convention of the Wisconsin Electrical Association of last January have been reprinted by Secretary George Allison (418 Stephenson Building, Milwaukee), acting under the authority of the association. The papers and discussion preserved in this form are as follows: "Some Facts Relating to Depreciation and Rate Making," by Mr. Halford Erickson, member Wisconsin Railroad Commission; "Voltage Regulation, Its Necessity and How Accomplished," by Mr. G. G. Post, electrical engineer of the Milwaukee Electric Railway & Light Company; "Report of Committee on Standards of Inspection for Overhead Distribution Systems," by Messrs. S. B. Way, Peter Valier and C. R. Phenicie; "An Accounting System for Small Central Stations," by Mr. H. G. D. Nutting, assistant to the president Clement C. Smith Properties.

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SOCIETY MEETINGS

Yonkers Division, New York Companies Section, N. E. L. A.—The final meeting of the season of the Yonkers division of the New York Companies Section, N. E. L. A., was held May 15. Mr. H. J. Otto presented a paper on "Service Rendered and Maintained by the Yonkers Electric Light & Power Company," and Mr. B. J. Aplin, general agent, presented a paper on "Contract Forms of the Yonkers Electric Light & Power Company." The principal speaker of the evening was the Rev. F. W. Cutler, who delivered his illustrated lecture on "The Panama Canal."

* * *

New York Electrical Society.—Dr. L. A. Bauer, director of the department of terrestrial magnetism at the Carnegie Institution of Washington, will lecture on the subject of "The Non-magnetic Yacht *Carnegie*—Her Work and Her Cruises" at the next meeting of the New York Electrical Society, to be held in Havemeyer Hall, Columbia University, May 25, at 8 p.m. The lecturer will relate in popular language the object and results of a general magnetic survey of the oceans undertaken on board the *Carnegie*. Dr. Bauer will also give a brief account of special exploratory parties sent under his direction to more or less unexplored countries in execution of the task intrusted to his department. Lieut. John Cyril Porte, R. N., will discuss informally "Aerial Navigation."

* * *

Patent System Large Contributor to Industrial Advance.—With Mr. Frederic P. Vose presiding and Mr. Max W. Zabel the speaker of the day, members of the Chicago Jovian League listened to an instructive discourse on patent law on May 18. Formerly, said Mr. Zabel, even a comparatively simple patent litigation could not be entered into at a cost of less than $3,000, but remedial rules have reduced this cost to from $500 to $1,000 for the less complicated suits, making it more practicable for an inventor to defend his rights in the courts. The United States Patent Office is not only self-supporting but is a paying organization, now having to its credit about $7,000,000. This money, many patent lawyers think, ought to be used to erect a new building and enlarge the system so that more speedy action could be had on applications. At present the Patent Office is about six or seven months behind with this work.

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Initiating Employees.—Before the Illinois Electric Railways Association in Chicago on May 15 Mr. Robert B. Stearns, vice-president of the Milwaukee Electric Railway & Light Company, read a paper on "Present-Day Electric Railway Problems." He gave some account of the extensive operations of his company and the companies that are allied with it in and near Milwaukee under the ownership of the North American Company. He said that the electric-service properties supply 45,000 customers and that the rating of the steam generating stations is about 80,000 kw. Mr. Stearns paid particular attention to the welfare work of the Milwaukee system. There are company sections both of the American Electric Railway Association and the National Electric Light Association. One rather novel feature is the maintenance of a "lodge hall" where employees are "initiated" with dim light, slow music and considerable hilarity. Second and third degrees of the "initiation" are given to those who desire to avail themselves of the insurance protection offered by the company.

* * *

Chicago Section of A. S. M. E.—At the meeting of the Chicago Section of the American Society of Mechanical Engineers on May 13 officers for the ensuing year were put in nomination as follows: Chairman, Mr. Samuel G. Neiler, Neiler, Rich & Company, consulting engineers; vice-chairman, Mr. H. M. Byllesby, of H. M. Byllesby & Company; secretary, Mr. H. M. Montgomery, of the Permutit Company. Other members of the executive committee are Mr. P. A. Poppenhusen, president of the Green Engineering Company, and Mr. Herbert S. Philbrick, professor of mechanical engineering in Northwestern University. The retiring executive committee consists of Mr. Paul P. Bird, C. W. Naylor, C. R. Birdsey, W. B. Jackson and A. W. Moseley. Speeches were made by Mr. James Hartness, Springfield, Vt. president of the American Society of Mechanical Engineers; Dr. W. F. M. Goss, Chicago, past-president of the society, and Mr. P. H. Gates, Chicago, past-vice-president. The paper of the evening, entitled, "Designing the Product," by Mr. Arthur M. Houser, of the Crane Company, Chicago, told of methods which should be applied in designing manufactured products so that they can be handled economically in the shop. Among the other speakers were Mr. Calvin W. Rice, New York, secretary of the American Society of Mechanical Engineers, and Capt. Robert W. Hunt, of Chicago.

* * *

Jovians of Southern California.—Under the direction of Mr. James N. Colkitt, statesman for southern California, a banquet followed by a rejuvenation was held on May 15 at the Clark Hotel, Los Angeles, with an attendance of 160, the record for southern California. Mr. K. E. Van Kuran acted as toastmaster and short speeches were made by a number of Jovians and candidates present. Mr. Max Lowenthal reviewed the development of the Jovian Order and made a plea for still further co-operation among its members. He expressed the belief that electrical merchandising should be carried on through its logical and legitimate channels. Mr. R. H. Ballard spoke in behalf of the candidates. A musical program was given during the banquet, and entertainment was furnished by Stentors J. H. Pieper and A. E. Morphy. Sixty candidates from Los Angeles and surrounding cities were initiated. The permanent degree team of Los Angeles carried on the work. This team is composed as follows: Messrs. J. G. Pomeroy, Jupiter; Ralph B. Clapp, Neptune; T. E. Burger, Pluto; L. E. Darrow, Vulcan; H. L. Miller, Hercules; J. C. Rendler, Mars; G. E. Arbogast, Apollo; D. H. Conover, Mercury; S. T. Snow, Avrenim. The Los Angeles degree team has been invited to go to San Diego during the convention of the Pacific Coast Jobbers' Association. It is planned to hold a rejuvenation on May 29 during this convention, and a large class of candidates is expected.

Illumination Features in New York Department Store

Show-window lighting and special features of interior illumination, various applications of motor drive, isolated generating-plant equipment, etc., at the Lord & Taylor store

LORD & TAYLOR'S recently completed eleven-floor department store on Fifth Avenue at Thirty-eighth and Thirty-ninth Streets, New York City, is unique among department stores because of its specially lighted show windows, its elaborate interior illumination, and the method of dressing its show windows (by lowering the window floors to the basement). In general the building is considered one of the most completely equipped of its kind in the world, many innovations having been made possible by electricity. Electrical energy is used also extensively in the packing and shipping departments and in the kitchen and laundries connected with an artistically illuminated restaurant on the top floor. A generating plant in the sub-basement supplies all of the electrical energy used in the building.

Show-Window Illumination

Since show windows are in reality nothing more or less than miniature stages especially intended for display purposes, it was decided to provide the principal windows in this store with a suitable system of illumination based upon modern stage-lighting principles. Each window is lighted so as to bring out the color value of the goods or gowns displayed in a manner that will give them as far as possible the appearance intended when in use, particular attention being paid to the illumination of street and evening gowns, furniture, millinery, silks and dress goods.

The system of show-window lighting employed in this building consists in general of the use of foot-lamps and front-border lamps inclosed in trough reflectors equipped with color filters instead of dipped lamps. It was found that the hue of the color filters is more permanent than that of the lamp dyes, and that no deleterious effects are produced on the lamps, such as reduced life and frequent burn-outs. Furthermore, color filters may be changed easily when it is desired to alter the color scheme of the illumination.

By the use of subdivided color filters (relatively few in number) practically any hue can be given to the color of the light, and even a fairly good match for daylight can be obtained. By employing color filters of different hues in the border lamps and the foot-lamps and by varying the relative intensity of light most interesting and beautiful natural effects can be produced, the tone of the light from above slightly modifying the color of the upper surfaces of goods in one direction, while the light from below modifies the color of the under surfaces in another direction. The resultant or mixed color appears on the high lights only.

This method of illumination as employed in Lord & Taylor's store is new to show-window lighting, although it has been previously employed in stage lighting. The

FIG. 1—BOWL AND BRACKET FIXTURES ON MAIN FLOOR

filters used had to be selected not merely from the viewpoint of the color of the light but also with relation to the color and texture of the goods illuminated. The successful application of the system demanded not only a

FIG. 2—ENTRANCE TO MEZZANINE FLOOR

knowledge of the spectral composition of the light transmitted by the several filters but also a knowledge of the coefficients of reflection throughout the spectrum of the many dyes used in coloring goods. In each case the reflectors used in the show windows under discussion were designed to give the proper distribution of light required to set forth the displays. They are generally of the shape shown in the cuts.

All street-floor windows facing on Fifth Avenue are 7 ft. 6 in. deep and 10 ft. 6 in. high, the corner window and those on each side of the main entrance being only 6 ft. wide, while the intermediate windows are 16 ft. wide. Facing the side streets are four types of display windows—shallow, deep, low and some arranged so that the displayed goods can be viewed from both the interior and the exterior of the store.

One-hundred-watt concentrated-filament tungsten lamps spaced about 1 ft. apart are used in the reflectors in the deep-set windows. Metal louvers and partitions are placed between the lamps in all corner-window reflectors to hide the filaments. Concentrated-filament lamps are used since they permit more accurate reflector design than is the case with other types of lamps having extended filaments. The foot-lamp reflectors are concealed by ornamental screens.

As the corner windows and those on each side of the main entrance can be looked into from more than one direction, special care had to be exercised in the arrangement of the lamps and reflectors to prevent any glare striking the eyes of passers-by. The corner display compartment is open to view through three plate-glass windows arranged at about an angle of 135 deg. with each other. Parallel to the middle pane is a reflector similar to the type used in the deep-set windows. Two other similar reflectors are placed parallel to the street walls, or at an angle of 135 deg. with the first. To prevent the filaments of these lamps being seen by the persons on the street, parallel sheet-metal vanes painted a dull black are attached to the reflectors about 2 in. apart and placed perpendicular to the longitudinal axis of the trough. The interior walls of the larger display compartments, which are made of dull-finish marble, assist in distributing the light evenly without producing any glare.

The Evening Room

Practically every modern dry-goods store is provided with what is known to the trade as an "evening room," lined with wall mirrors and brilliantly lighted. The limitations of such equipment have been eliminated in the Lord & Taylor "evening room" by employing a system of illumination that makes it possible to display gowns or materials under any color of light desired. If a tentative purchaser desires to see herself arrayed in a street dress, the room can be lighted to simulate daylight. If, on the other hand, an evening gown is to be observed under some particular color of illumination, that hue can be produced by the equipment installed.

The desired results are achieved by employing a development of the system of illumination used in the main show windows. Several reflectors with permanent color filters are used, the lamps behind each color filter being separately controlled as to intensity by remotely controlled dimmers. The latter are operated by push-buttons in the room itself, and the degree of each color required is set by indicating instruments calibrated in terms of color instead of current. The calibration is variable and can be readily adjusted. The color screens employed are selected for such spectral composition of transmitted light that the composition of the resultant light will closely approach the composition of a predetermined value of daylight. The light transmitted through the color filters is projected into the room through diffusing plates of low absorption set in the ceiling. By this arrangement the color of light in any direction in the room is consistent, the interior of the room being white and gray.

Mechanical Devices for Show Windows

An innovation has been made by constructing the Fifth Avenue show windows with movable floors which

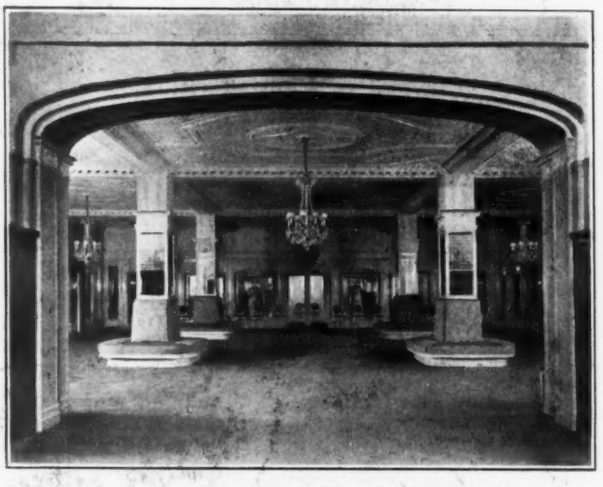

FIG. 3—CHANDELIER IN SALON

may be lowered to the basement for redressing. The floors in most cases are raised and lowered by hydraulic plunger pistons, but motor-driven apparatus is employed on one which is situated over an underground

driveway to avoid obstructing the passageway with a hydraulic plunger.

The floors of the windows, instead of being permanently fastened to the hoisting apparatus, are clamped to platforms which are themselves rigidly attached to the plungers. After a floor is lowered for redressing it may be replaced by another usually kept in readiness. For transferring the floors from the lift to the dressing platforms in the basement transfer trucks have been provided which run on a track parallel to the sidewalk on the street above. With a floor resting on one of the dressing platforms the window decorator can arrange things and obtain an idea of how the display will appear before it is raised to the street level.

The windows on each side of the Fifth Avenue entrance have circular floors pivoted on vertical shafts which can be slowly rotated by a motor through a worm and gear. On each turntable will be supported two intersecting vertical partitions, dividing the circular platform into four equal sectors. Dummy models will be placed in each of the compartments thus formed, only one of which can be seen from the same window at a time, the others being successively brought into view as the platform rotates. About six to eight minutes elapses between each change, and during the transition a curtain is automatically drawn across the plate-glass windows. The turntable and curtain-operating mechanism are interconnected so that the drape is drawn before the platform revolves.

Another feature of the show-window equipment is the provision for utilizing the space in front of the main entrance after closing hours to accommodate a disappearing display cabinet which exactly fills the recessed entrance. The floor in front of the main entrance is actually the roof of the disappearing cabinet, which is designed to harmonize in depth, height, fittings and illumination with the other Fifth Avenue windows. The cabinet is raised and lowered by a plunger piston. This cabinet is also illuminated by Frink reflectors containing concentrated-filament lamps separated by louvers.

Other Types of Show-Window Illumination

At the south entrance to the building is a low, shallow show window open to view from both the interior and the exterior of the store. The street-observation

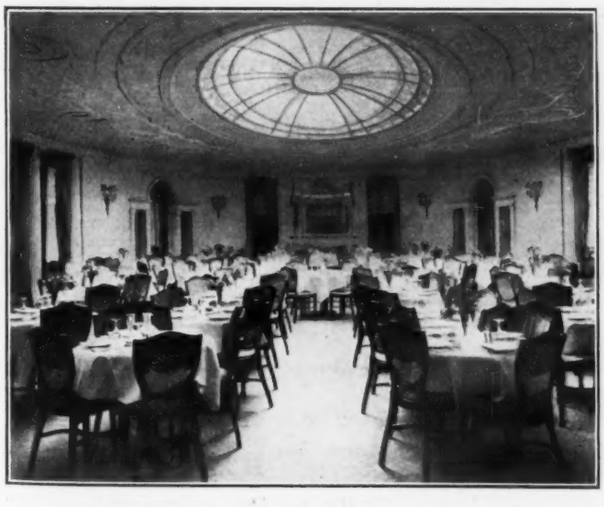

FIG. 4—ONE OF THE RESTAURANT HALLS

floor level is lower than the store floor level so that illumination different from that in the other windows is provided to protect the eyes of observers on either side from glare. Concealed in a recess in the ceiling by a rectangular, diffusing-glass plate are 100-watt tungsten lamps supported in a Frink reflector trough. The diffusing plate is inclosed in a frame hinged along its longer edge so as to swing downward and allow in-

FIG. 5—MAIN-FLOOR AISLE

spection or replacement of the lamps and reflectors above.

Interior Illumination

Another feature of store illumination is that special combination direct-indirect fixtures are used throughout the entire eleven floors of the building. Supported by chains from groined-arch bays in the main floor are about ninety polycase opal-bowl direct-indirect fixtures emitting light approaching the color of subdued daylight.

Each fixture consists of a bowl within a bowl—the inner one blue and the outer one opalescent. The light from the tungsten lamps in passing through both bowls is tempered in quality, giving an illumination which is extremely desirable for examining colored goods. The fixtures on the street floor as well as those on the other floors are arranged in bays 20 ft. square. The ceiling on the street floor, which is made of dull-finish tan-colored Travertine marble, similar to that used in the larger show windows, prevents any specular reflection from the lamps in the fixtures. Stretched across the lower surface of each bowl is a fine wire mesh which will prevent pieces of glass falling if the fixtures are broken by heat or mechanical injury. Six 150-watt tungsten lamps are supported in each fixture by Benjamin clusters. Each bowl fixture is covered with an opal glass plate which allows about 30 per cent of the light to strike the ceiling, the remainder being directed downward through the bowls. All lamps on this floor are controlled by master switches.

Direct-indirect fixtures are also used on the other floors, but they are supported by a central pendent rod and are not protected with wire mesh as the bowls are more rugged in construction than those on the main floor. A larger proportion of the illumination is indirect on these floors, about 50 per cent of the light being directed toward the ceiling.

Showcase Lighting

Showcase lighting is quite generally the same throughout the building, straight filament fixtures being concealed under the outer upper edge of the cases.

In the women's millinery section the showcase lighting is different. The cases rest on stands about waist-high and are painted with white enamel within and without. The light is emitted entirely from the ceiling of the cases through a translucent glass plate and is adjusted in intensity so that it is not apparent on first observation where the light originates.

For trying on hats special lighting fixtures, multi-view mirrors and seats at regular and frequent intervals are employed. The fixtures consist of pendent-type, conical-shaped, buff-colored silk reflectors containing one 40-watt tungsten lamp.

Illumination for Theatrical Costume "Tryons"

Large metropolitan stores usually have their "evening rooms" for trying on evening gowns and theatrical costumes, but the Lord & Taylor store has been equipped with a stage to give the actual illumination effects on costumes which are obtained back of the lighted foot-lamps. There are two stages, one quite large stage in the auditorium and a smaller stage in the salon. The large stage is provided with the usual border and foot-lamps with dimmer equipment and plugs for spots and floods so that a complete production can be shown.

The salon stage is intended more for individual stage-gown demonstration than for ensemble presentation. The stage is architecturally a foyer, with a provision at the rear for introducing suitable scenic backgrounds. The sides of the foyer are provided with large mirrors in front of which are hung curtains of rich material that can be readily drawn aside. Disappearing foot-lamps are arranged across the front of the foyer and along both sides at the foot of the mirrors. These foot-lamps are operated by an ingenious mechanical device that opens up a part of the stage floor and simultaneously brings the "foots" into position.

Concealed border lamps are provided back of the proscenium arch and along each side of the foyer. The

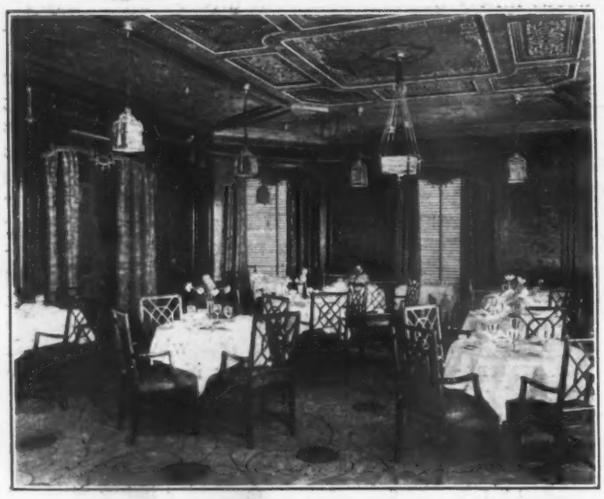

FIG. 6—ORIENTAL FIXTURES IN MANDARIN ROOM

back drop is lighted by means of a new type of border lamp recently introduced into stage lighting. This reflector produces a sheet of light which can be thrown over the drop surface without setting the reflector more than a few inches from the drop, thus economizing both space and light.

The foot-lamps are novel in that they consist of separate cellular units, each with a color filter, the units in each color being controlled separately. This type of "foot" has several advantages over the usual form and has been recently introduced into theatrical work. By means of this form of reflector not only the color of light but also its direction is under control.

On the same floor as the salon is a promenade lighted

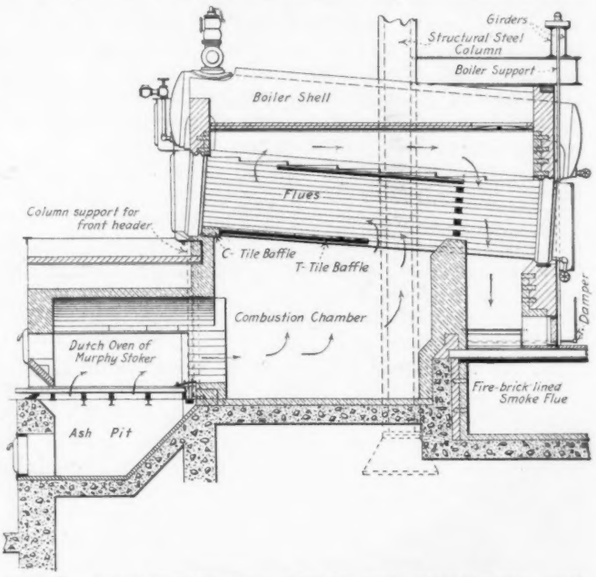

FIG. 7—HIGH-EFFICIENCY BOILER FOR SMOKELESS COMBUSTION

by crystal chandeliers where models may parade to give patrons an idea how gowns will appear under similar conditions of lighting. Along the walls of this promenade are cases in which dummy models are displayed. The interior of each case is lighted in a similar manner to that employed in the hat-display cases previously described.

Restaurant Lighting

On the eleventh floor of the building is an elaborately decorated and illuminated restaurant and lobby. Portable pedestal fixtures are used extensively on this floor. They consist of sand-blasted vase-shaped glass lanterns supported on filigree bronze and marble standards conforming with the architecture of the rooms. Bracket-type fixtures supporting lanterns of similar design are also employed. The architecture on this floor follows that of the Adams period.

In the "mandarin room," which is one of the three halls composing the restaurant, are used elaborate imported ornamental, electrically lighted Chinese silk lanterns of various designs. In another part of the restaurant adjoining this room artificial light is provided by an electrically illuminated stained-glass dome. It is elliptical in shape and consists of numerous vari-shaped sections of stained glass intermeshed to form an attractive antique pattern. About 100 60-watt tungsten lamps inclosed in Frink reflectors are arranged near the periphery and above the crown of the dome to give even illumination.

Elevator Lighting

Lighting features were not exhausted in equipping the parts of the building already described. The elevators, of which there are twenty, are provided with direct-indirect fixtures, having elliptical-shaped oval glass bowls supported just below the ceiling of the cage. The greater part of the light is diffused through the bowl, as the ceiling is coated with gold-leaf, which is inefficient as a reflector or diffuser because of its light-absorbing qualities. The walls of the elevator are

paneled with glass and decorated in the Louis XVI style. Attached to the top of each cage directly over the lighting fixtures is an electric fan for ventilating the elevator.

Exterior Illumination

The exterior upper portion of the Lord & Taylor building is decorated by a handsome colonnade capped by architrave, frieze and projecting cornice. By setting reflectors between the columns on the base line a sheet of light is thrown upward along column and frieze to the underside of the cornice, every molding and relief being sharply contrasted with the sharp shadow above. By this means the structural lines are emphasized and the fine proportion of the order clearly set forth, while the source of light is entirely concealed. This arrangement can also be used for lighting sheer wall surfaces, the reflectors being set close to the wall foot.

Package Sorting, Packing and Delivery Departments

Sorting, packing and preparation for the delivery of packages is accomplished in the basement. Rigid-pendent X-ray reflector fixtures containing 100-watt lamps are employed for illuminating this section. Goods are delivered from each of the main-floor sections to wrappers and change-makers in the basement by pneumatic elevators. Duo-credit phones are placed at each change-maker's station so that charge accounts may be verified by calling the credit office. These devices are designed to make duplicate marks on the auditor's and customer's stubs, instead of making only one impression on the sales slip as is usually done.

The signaling apparatus on the credit phones is arranged to facilitate rapid investigation of a patron's credit. On the base of each telephone is a set of push-buttons each representing a certain group of letters in the alphabet. By pushing the button representing the first letter of the customer's name the calling party is brought into direct communication with the girl having the particular record in charge.

Wrapped goods from floors up to the ninth, not including the street floor, are conveyed to the basement by a chute and delivered onto a motor-driven canvas-belt conveyor which conducts them to primary sorters. Here the packages are distributed systematically direct from the belt conveyor, among men who sort them according to their destination. Goods going to Jersey City, for instance, are thrown onto a belt conveyor leading to the particular loading platform of that district, while those for Manhattan Island are conveyed by similar means to another platform. The conveyor equipment, which was furnished by the Alvey-Ferguson Company, Cincinnati, Ohio, is most elaborate. About thirty-six motors, ranging in size from 0.5 hp to 5 hp, are used to drive it.

All delivery wagons are driven into the basement of the building along a sloping driveway and are backed up to concrete platforms for loading. To avoid congestion in the driveways, to lower the cost of delivery and to decrease the delay in delivering, Lord & Taylor are replacing all of their horse vehicles with forty-three electric delivery wagons and a few large Peerless gasoline trucks. The drives leading from the basement to the street level are illuminated by 150-watt tungsten lamps inclosed in enameled-steel reflectors recessed flush with the concrete ceiling. The garaging facilities were more completely described in the April 11 issue of the *Electrical World*.

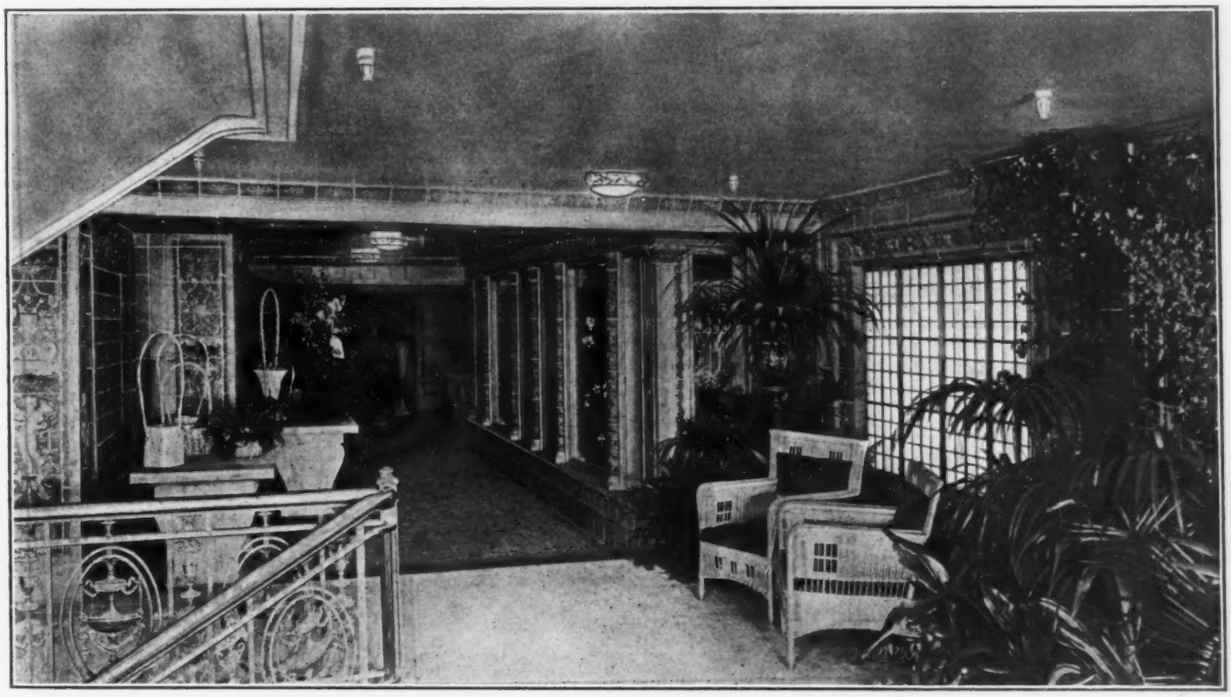

FIG. 8—ILLUMINATING FIXTURES ON FLOWER BALCONY

Motor Applications in Kitchen and Laundry

Connected with the restaurant are a kitchen and a laundry in which motors are employed to drive various pieces of machinery. All china is washed in electrically operated washing machines, meats are sliced by machinery, ice-cream is made in a motor-driven freezer, the ice machine is driven by a motor, ice is sawed into blocks and crushed to various degrees of fineness by electric machinery, etc. The kitchen equipment, which required ten motors in sizes from 0.25 hp to 3 hp, was furnished by the Du Parquet, Huot & Moneuse Company, New York.

In the laundry where table linen and waiters' clothes

are washed the machinery is all driven by motors. Installed in that department are three washers, a drier, a mangle and an ironer furnished by the Troy Laundry Company, Chicago. For ironing the more delicate fabrics electrically heated flatirons are used. Nine motors, ranging in sizes from 0.5 hp to 10 hp, are employed.

Boiler and Generator Room

All of the energy used in the building is generated in an isolated plant in the sub-basement. In the boiler room are installed seven Heine boilers, six of which are rated at 250 hp and one at 400 hp, making a total of 1900 hp. These are equipped with Murphy stokers, and both forced and natural draft are provided.

The furnaces have large combustion chambers which permit of burning bituminous coal without the production of smoke. By covering the lower row of boiler tubes with T tiles the flames are prevented from striking a cold surface before they have traveled 10 ft. from the grate. The same tubes adjacent to the front boiler

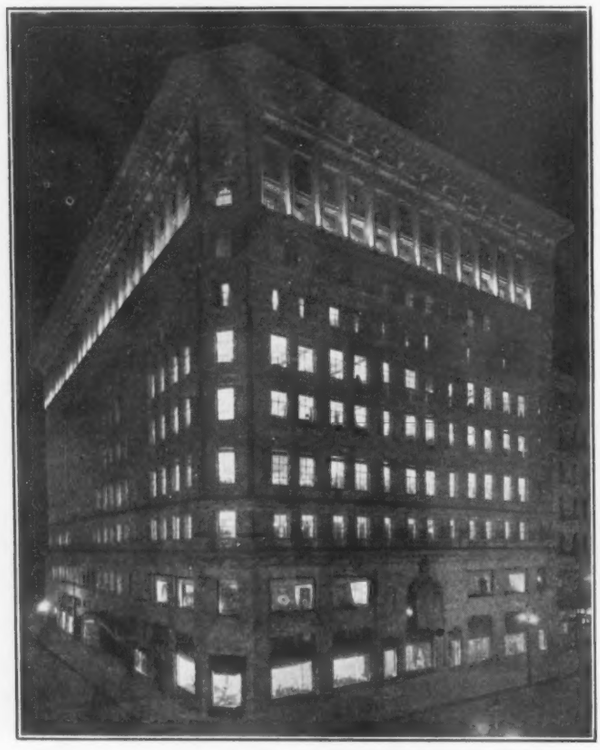

FIG. 9—LORD & TAYLOR'S BY NIGHT

header are covered with C tiles. The gases enter the first pass at about the middle of the boiler, flow parallel to the tubes until they reach the front header, when they reverse in direction, passing under the boiler drum, and then flow downward across the rear end of the boiler tubes into a concrete smoke duct connecting with the stack. The boilers are supported at the front by columns bolted to brackets on the front water legs and at the rear by girders laid on the building beams.

In the engine room are installed four 300-kw, 250-volt, two-wire Crocker-Wheeler generators directly connected to simple horizontal steam engines manufactured by the Robert Wetherill Company, New York. The generators deliver energy to two buses supplying motor and lamp circuits. Across the lamp-circuit buses are connected two Crocker-Wheeler balancer sets. All of the machines are remotely controlled from a bench-board by master switches.

No storage batteries are employed to operate the switches, as each unit including its momentary-contact relay is energized directly from the particular machine which it controls. Machine panels are installed near each generator, and the generator bus leads are run through the floor to the rear of the main switchboard. The field rheostats are operated by motors, which are also fed directly from their respective machine terminals. At present both motors and lamps are being supplied with energy from the same bus to hold up the load-factor. The normal lamp load is about 700 kw and the motor load about 113 kw. The energy consumed per day is approximately 8300 kw-hr.

The exhaust from the engines is used for heating the building and boiler-feed water. There are also installed in the basement a refrigerating system, some hydraulic pumps for lifts and domestic water service, and a compressor delivering air for operating elevator doors and dumb-waiters.

Other Motor Applications

This building is equipped with a small machine shop, in which the machine tools are driven by individual motors ranging in size from 0.5 hp to 5 hp. A gymnasium has been equipped with Zander-Swedish exercise apparatus for the use of the employees during rest hours. Some of these machines are driven by electricity. Motors for operating the extensive ventilating system in this building were furnished by the Sprague Electric Works of the General Electric Company, while all of the rest of the motors (numbering about eighty-five) were supplied by the Crocker-Wheeler Company.

The Lord & Taylor building and its equipment were designed by Messrs. Starrett & Van Vleck, architects, New York City. The engineering work was supervised by their engineer, Mr. Edward E. Ashley, Jr. The show-window lighting system, as well as the lighting of the evening room and some features of the stage lighting, was designed for Lord & Taylor by Mr. Bassett Jones. All reflectors, including those used in the stage equipment, showcases, show windows, exterior illumination, evening room, etc., were made by I. P. Frink and furnished by the H. W. Johns-Manville Company. Messrs. Johnston, Livingston & Company, New York, installed the lighting fixtures and were the general electrical contractors. All the semi-indirect lighting glassware was made by the Gleason-Tiebout Glass Company, of New York.

Atmospheric Electric Observations on Ocean Air

Incidental to the second cruise of the non-magnetic yacht *Carnegie* from June, 1910, to December, 1913, a number of observations of atmospheric electrical phenomena were made in the various oceans over which the cruise extended. Potential gradients were read by electroscopes supported over the rear of the ship by long bamboo poles. Radioactivity was measured in terms of the rate of discharge of a bare copper wire which had had an initial charge of 2000 volts. In reporting the results obtained before the American Physical Society at Washington, D. C., recently, Mr. C. W. Hewlett said that while the potential gradient of the atmosphere over the ocean was found essentially the same as that over land, the radioactivity of sea air was smaller compared with that over land. On the other hand, the conductivity of the air over the ocean proved to be larger than for air over land, the rule apparently being that the smaller the ocean the larger was the conductivity observed. For the Pacific Ocean the average conductivity found was 2.51; for the Atlantic, 3.35, and for the Indian Ocean, 4.28.

"Electric" School Building of Rupert, Idaho

An educational institution which is heated by electrical energy—Manual-training and scientific departments and cooking classes also depend on it. By T. W. Halliday

WHILE the West is regarded—chiefly by the Easterners—as less advanced in many ways than the East, the town of Rupert, in the newly reclaimed sage-brush desert of Idaho, has come forward as a rival to the older and supposedly more progressive cities of the East by converting a dream of the past into a reality of the present. This dream looked forward to the complete utilization of a power that was once merely a magic force, but through the persistent efforts of the dreamers stage after stage of practical application has been reached, first for lighting, then for motors, and more recently for cooking. Rupert has gone still one step farther and has adopted electric heating. Nor is this to any limited extent, for all other methods of heating are being rapidly supplanted.

Since the first of the year a new installation has been completed, which not only overshadows all the previous equipments of this locality, but stands out as a successful demonstration of the practicability of its wider application to all the needs of a community. Rupert's new high school building is equipped electrically throughout. Warmth is provided for by an electric furnace, the cooking of the domestic science department is done on electrical appliances, the machinery of the manual training room is electrically driven, the apparatus of the science departments is electrically operated, and the lighting is, of course, electric in keeping with the rest of the equipment.

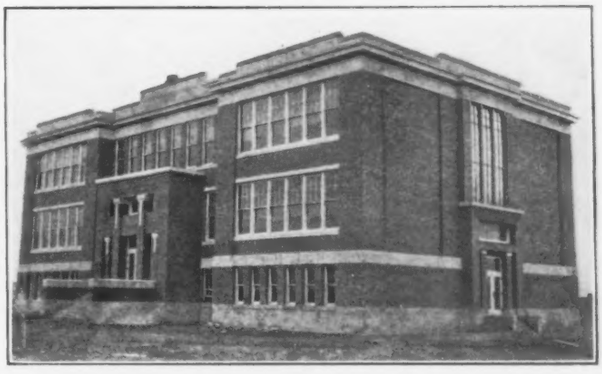

FIG. 1—THE "ELECTRIC" HIGH SCHOOL, RUPERT, IDAHO

The Heating Plant

The heating plant is similar to the combined heating and ventilating systems now in common use in public buildings with the exception that an electric furnace is substituted for one using coal, oil or gas. This substitution not only saves a great deal of space that may be more profitably used but is absolutely free from dirt and the gases of combustion.

The furnace unit consists of eleven Simplex cast grid resistor units, each unit taking 83 amp at 440 volts and therefore consuming 36.52 kw, the total rating of the furnace being 401.72 kw. These units are arranged in a breast of seven and with a wing of two units at each end across the openings from the fresh-air ducts and at 90 deg. to the main breast. The units are each 12 in. deep, 18 in. wide and 56 in. high and occupy a floor space of but 16.5 sq. ft. This space would have been hard to utilize with any other form of heating apparatus as the end of the fan room communicating with the fresh-air ducts, where the units are placed, is below the landing of the main entrance and the ceiling height is but 5 ft.

Regulation is accomplished by a switchboard placed in the superintendent's office on which are mounted eleven double-pole, double-throw knife switches, each switch controlling one unit of the furnace. The board is supplied with both 220-volt and 440-volt, three-phase current. As cutting the voltage down to 220 on a unit will reduce its kilowatt rating to one-fourth, any unit may be cut down in rating to 9.13 kw by simply throwing over its control switch, and so by using the proper combination of switches and voltages the furnace rating may be increased or decreased in about 9-kw steps throughout practically the whole of its entire range, there being forty-one steps in the control.

The building is kept warm at night by placing all units on a 220-volt circuit. The inside re-circulation of the air of the building then maintains the temperature and at the same time furnishes sufficient ventilation so that there is no danger of the units burning out from overheating. To protect the units from overheating in case the circulating fan should stop when the heating units are on a 440-volt circuit and delivering full heat, thermostats are located at intervals above them and are connected in circuit with a solenoid in the transformer room which operates the trip on the oil switch and switches off the circuit.

The ventilating fan, built by the Louis Burton Company, of Seattle, delivers 20,000 cu. ft. of air per minute. This fan is driven by a General Electric 10-hp adjustable-speed motor installed in the manual-training room, the power being transmitted to the fan by a line shaft passing through the wall. This motor is also used to drive the band-saw, turning lathe and other machinery of the manual training department.

The transformer used for the heating plant is a Westinghouse three-phase, 300-kva unit, with 3800-volt

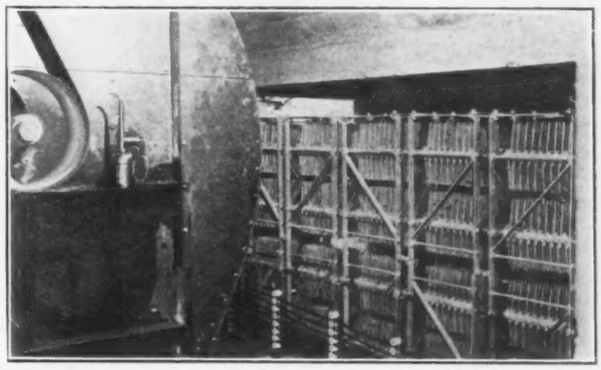

FIG. 2—HEATING UNITS, SHOWING VENTILATING FAN AT LEFT

star-connected primaries and 220-440-volt delta-connected secondaries. This transformer, as well as a 10-kva unit for lighting, the oil switch and other accessories, is housed in a fireproof room 8 ft. by 11 ft. In the original plans of the building a steam plant was contemplated, and the library room, which is 20 ft. by 30 ft., was to have been used for the boiler room. The electric installation therefore gives an additional floor space of 382 sq. ft., while a considerable saving in the original cost of the building was effected by being able to do away with a large underground cellar that was planned to be used for coal storage and for the removal of ashes.

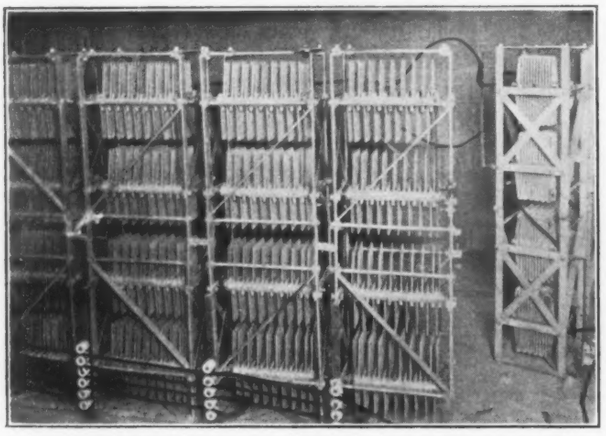

FIG. 3—PART OF MAIN BREAST OF HEATING UNITS

The total cost of the plant as compared with plants employing other forms of heat was about half that paid for the systems installed in other public buildings in that part of the country for similar service. In going into the operating cost of the heating plant only the cost of the electric energy need here be considered, and attention is called to the fact that practically no attendance is required and that the ventilating cost in any other system would be the same.

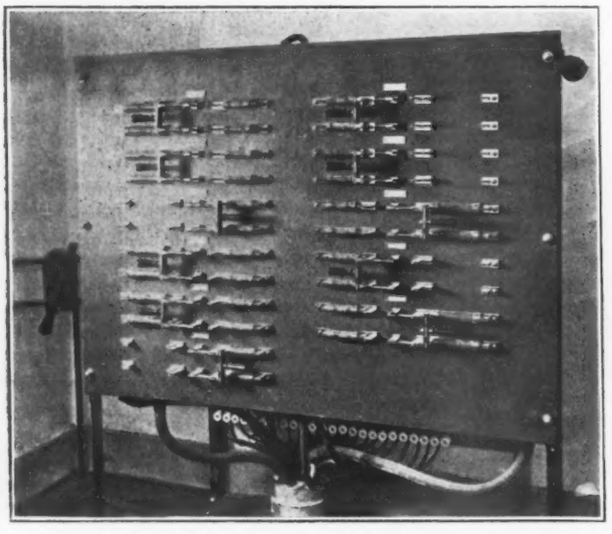

FIG. 4—SWITCHBOARD IN SUPERINTENDENT'S OFFICE FOR CONTROLLING HEATING UNITS

In the original estimate given the school board, with all factors considered and the total energy cost placed at $1,760 per annum, the electric plant showed a saving of about $300 a year over other forms of heating. In making this estimate a maximum load of 300 kw was used as a basis, but actual operation has placed the maximum demand at 264 kw, and on this basis the yearly estimate is placed at about $1,440, showing an additional saving of $320 annually. The heating rate for energy is $1 per kw-month, and the maximum load must be paid for four months continuously in each heating season.

The plant, as a practicable idea, was first conceived of by Mr. B. Dibble, the government electrical engineer of the Minidoka Reclamation Project, his assistant, Mr. Bixby, and the Rupert Electric Company, the design and details of construction having been worked out by the Rupert Electric Company.

FIG. 5—DOMESTIC-SCIENCE CLASS

Domestic Science

The present electrical equipment of the domestic science department requires 5970 watts and consists of eighteen Simplex 4½-in. disk stoves with a rating of 250 watts each and two 8-in. disks of 735 watts rating each. Each stove is supplied with a "blazer" or frying pan and a double boiler, these utensils being all that are necessary to carry on the operations ordinarily performed on top of the stove. The cost of operating this equipment is about 12 cents per hour on high heat. In the near future an addition is contemplated in the way of a range of about 7770 watts rating and a pair of hot plates, to be used for serving cafeteria lunches to the pupils. These articles were not included in the original equipment for reasons easily appreciated by those experienced in trying to equip a new building completely on a bond issue based on the estimated cost.

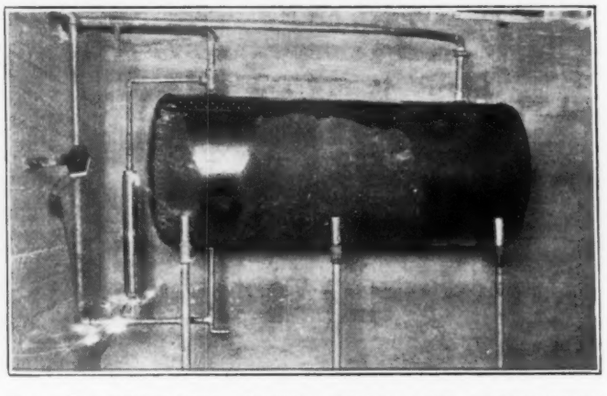

FIG. 6—HOT-WATER SUPPLY TANK AND CIRCULATING HEADER

The initial equipment of the laboratories, for reasons above mentioned, amounts to but 2235 watts and

is utilized in a still, evaporating plates, and test-tube heaters. Other devices, such as an electric furnace, individual test-tube heaters, etc., are being made by the instructor and the students to meet their individual views and requirements.

Hot water is furnished by having a 3000-watt Simplex circulating heater connected to a 280-gal. tank.

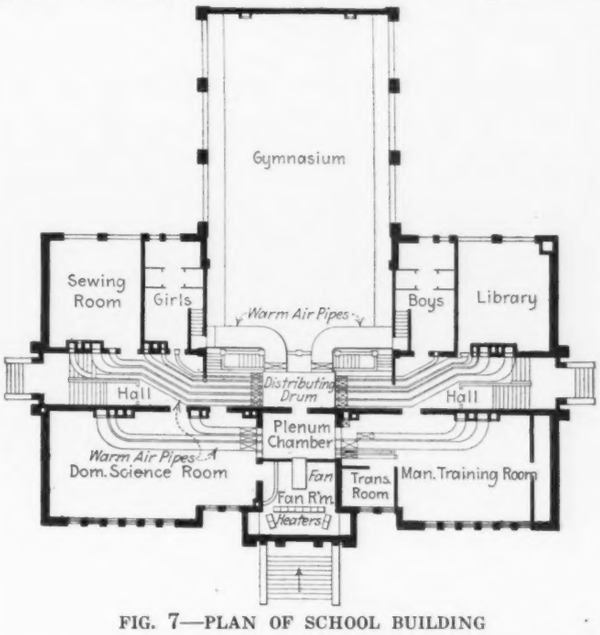

FIG. 7—PLAN OF SCHOOL BUILDING

This tank is placed in the plenum chamber in order to avoid the necessity of insulating it against loss of heat and supplies all of the hot water used in the building.

The total installed lighting load amounts to 12,505 watts, although an ultimate maximum installation of 20,120 watts is contemplated and has been provided for.

Cost of Operating for the Month of February, 1914

The costs of the various uses of electricity in this building for the month of February were as follows:

Heating	$264.00
Power	25.90
Water heating	7.35
Lighting	6.90
Cooking and appliances	3.35
Total	$307.50

A brief summary of the rates in effect in Rupert is as follows:

	Per Kw-hr.
Lighting and small appliances	7 cents to 5 cents
Cooking—fifty-hour-demand basis	2 cents to 0.55 cent
Power	5 cents to 0.55 cent
Water heating	1 cent to 0.70 cent

The heating rate is $1 per kw per month, flat rate, provided that the maximum connected load be paid for four months continuously in each heating season, which runs from Sept. 1 to June 1.

The Boston Navy Yard's Big Electric Crane

The electrically operated 150-ton cantilever-bridge-type crane recently completed at the Charlestown Navy Yard, Boston, Mass., is the largest floating crane on the Atlantic Coast. The "bridge" overhangs at each end of the 125-ft. pontoon and the trolley travels the entire length of the bridge. The hoisting equipment consists of two main hoists, each with a capacity of 75 tons, able to operate simultaneously. There is an auxiliary trolley and hoist with a capacity of 15 tons.

Accentuation of Pain at the Cathode in Undergoing Electric Shock

In the course of several years' experimentation Prof. F. J. Rogers, of Princeton University, has tested the endurance of a large number of students and others to discover the maximum direct current which can be borne without excessive pain, and he finds this value to average about 20 milliamp, although some hardy subjects withstood 40 milliamp without wincing. It is commonly known, of course, that if a given current strength be passed into the body over a small electrode area the pain will be more intense than if a larger contact is used. Where, however, both electrodes were of the same size, the subject often complained of greater pain in one arm or the other, and on investigation Professor Rogers found it to be invariably the cathode where sensation was accentuated. The same rule appeared to hold true whether the current was passed between the fingers, the ankles, the hands or other parts of the body—always the cathode member was the first one to become painful with the increasing strength of the electric current. Not a single exception occurred to mar the invariability of the result thus attained.

Improved Method Used in Magnetic Separation of Iron Ore from Gangue

An interesting modification of the usual method of separating magnetic iron ore from gangue is employed at the Witherbee, Sherman & Company's mines, Mineville, N. Y., where it is applied to 0.25 in. lumps or finer ones. The belt feeding the crude ore is placed with respect to the take-off belt as shown in the diagram. A series of electromagnets is suspended above the lower span of the take-off belt. The coils are connected so that adjacent magnets are of opposite polarity. As the crude ore on the feed belt passes under the first magnet the magnetic ore is attracted to the take-off belt, while the gangue drops off into the tailings hopper.

The particles of ore in being carried along by the take-off belt have first one end attracted by one magnet and then the other attracted by the adjoining pole-piece because of the changing polarity. This turn-over process continually mixes up the ore and allows the gangue to drop out. The concentrated ore drops off from the take-off belt in the concentrates hopper after passing by the last magnet. The bulk of material delivered from this hopper to the rolls and final treating machine is thus reduced without in any way sacrificing the iron content.

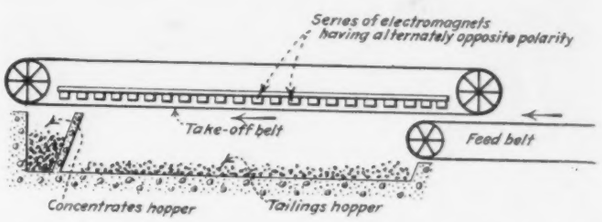

DIAGRAM ILLUSTRATING THE MAGNETIC SEPARATION OF IRON ORE FROM GANGUE

Direct-current energy at 125 volts is used in the magnets. From 3 amp to 7 amp is required in the belt machines, depending on the size of the ore handled. The degree of refinement obtained depends partly on the attractive force of the magneto, the air-gap and the belt speed.

Transformer Core-Loss Separation

Experimental investigation of the variation of eddy-current and hysteresis losses with change in frequency and magnetic density. By E. R. Shepard

IN making an experimental study of a transformer, the necessity of an intimate knowledge of the magnetic properties of the iron involved presents itself. To assume that a magnetization curve found in a handbook and labeled "transformer iron" will fit the particular specimen under consideration is far from satisfactory. To select hysteresis and eddy-current constants from values which may vary by 100 per cent or more is inconsistent with the best academic practice. The magnetic properties of the transformer iron may be obtained by experiment provided the core dimensions and the winding data can be secured, and it is sometimes possible to obtain the desired data from the manufacturer.

The total core loss of a transformer at different flux densities can be determined by measuring with a wattmeter the input to one winding supplied with energy at different voltages, while the other winding is on open circuit. The input as indicated by the wattmeter includes both the hysteresis and eddy-current losses and a small I^2R loss in the copper of the primary winding which under ordinary conditions may be neglected. The separation of the hysteresis and eddy-current losses may be accomplished by several independent methods. One of these methods involves the assumption that the hysteresis loss varies as the 1.6 power of the maximum flux density. While this is not a violent assumption, the constant 1.6 is only an average value obtained from tests on many samples of iron and may not apply to the particular sample under consideration.

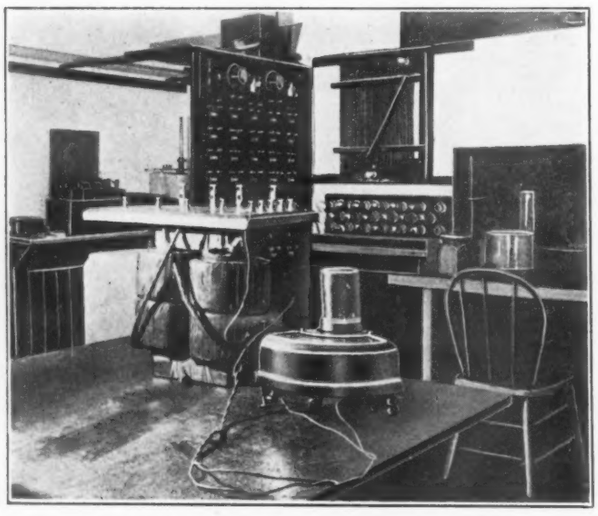

FIG. 1—LABORATORY TRANSFORMER AND FLUX-METER

Another method depends upon the fact that the eddy-current loss varies as the square and the hysteresis loss as the first power of the frequency. This method requires the measurement of the losses at widely different frequencies and is attended with more or less uncertainty. A third and theoretically correct method involves the measurement of the hysteresis loss directly from the areas of a number of hysteresis loops taken on a sample of the iron, under various degrees of maximum induction. All three of these methods were employed and the results are shown by the accompanying curves.

For conducting the tests herein recorded use was made of a standard 2.5-kw lighting transformer of the core type, to which were added a special twenty-five-turn winding with taps at two, five, ten and twenty turns for use in connection with a flux-meter or ballistic galvanometer. A terminal board was mounted on the transformer and all leads were brought to binding posts on this board. The accompanying figure shows the transformer and flux-meter.

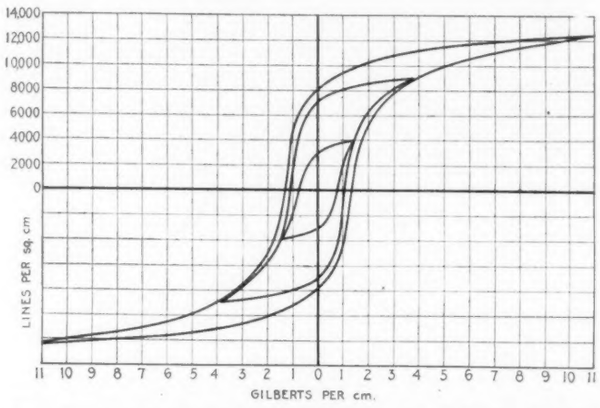

FIG. 2—HYSTERESIS CURVES TAKEN ON 2.5-KW TRANSFORMER

The results of a core-loss test which was conducted at the Oregon Agricultural College under the direction of the author may be of interest.

The tests were designed to give a thorough understanding of magnetic hysteresis and eddy currents and the energy losses attending these phenomena. The following constants apply to the transformer under test:

Cross-sectional area of core.....36.4 sq. cm = 5.65 sq. in.
Mean length of flux path.....73.7 cm = 29.0 in.
Thickness of laminations.....0.0356 cm = 0.014 in.
Weight of iron .....20.6 kg = 45.3 lb.
Volume of iron.....2670.0 cu. cm = 163.0 cu. in.
Primary winding contains approximately 2800 turns of No. 18 wire.
Secondary winding contains 281 turns of No. 8 wire.
Primary resistance .....22 ohms
Secondary resistance .....0.18 ohm

In obtaining the hysteresis loops on the transformer core use was made of a flux-meter. This is by far the simplest and quickest device for carrying out what is ordinarily a tedious and laborious test. The flux-meter is essentially a very sensitive ballistic galvanometer. The deflection is independent of the rate of change and the readings may be taken leisurely. With this instrument the readings for a complete hysteresis loop may be obtained by the step-by-step method in fifteen minutes, and if the proper care is exercised the results should check within 1 per cent. Eight hysteresis loops, three of which are shown in Fig. 2, were obtained from

the transformer core in this manner, the flux densities ranging from 4000 maxwells to 14,000 maxwells per square centimeter. The areas of these loops were carefully measured with a planimeter and the results plotted as curve E in Fig. 3. Curve A in the same illustration shows the total core loss in ergs per cubic centimeter per cycle as measured by a Thompson indicating watt-

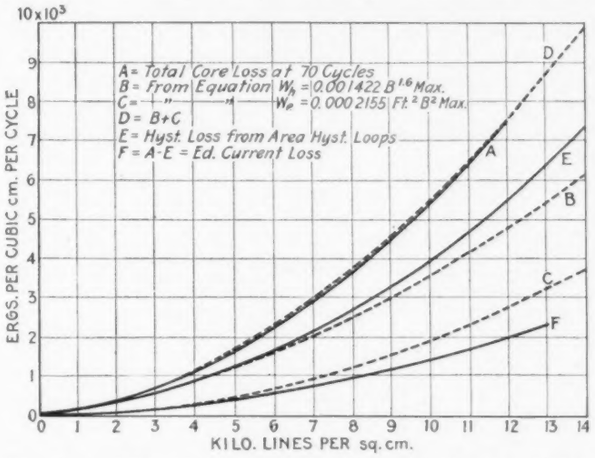
10x10³
A = Total Core Loss at 70 Cycles
B = From Equation W_h = 0.001422 B^1.6 Max.
C = " " W_e = 0.0002155 Ft.² B² Max.
D = B+C
E = Hyst. Loss from Area Hyst. Loops
F = A-E = Ed. Current Loss
ERGS. PER CUBIC cm. PER CYCLE
KILO. LINES PER sq. cm.

FIG. 3—OBSERVED AND CALCULATED CURVES OF TRANSFORMER CORE-LOSS

meter when the transformer was subjected to a sine-wave emf at a frequency of seventy cycles. By making the assumption as indicated above this curve can be separated into eddy current and hysteresis loss in the following manner: Select two points on the curve having ordinates W_1 and W_2, then

$$W_1 = \eta_1 \mathfrak{B}^{1.6}{}_1 + \varepsilon f t^2 \mathfrak{B}^2{}_1$$

and

$$W_2 = \eta_1 \mathfrak{B}^{1.6}{}_2 + \varepsilon f t^2 \mathfrak{B}^2{}_2$$

f being the frequency and t being the thickness of the laminations. The constants η_1 and ε were determined from two such equations and found to be 0.00142 and 0.000215 respectively. Using these constants in the well-known hysteresis and eddy-current equations, the curves B and C are obtained. Their sum is plotted as

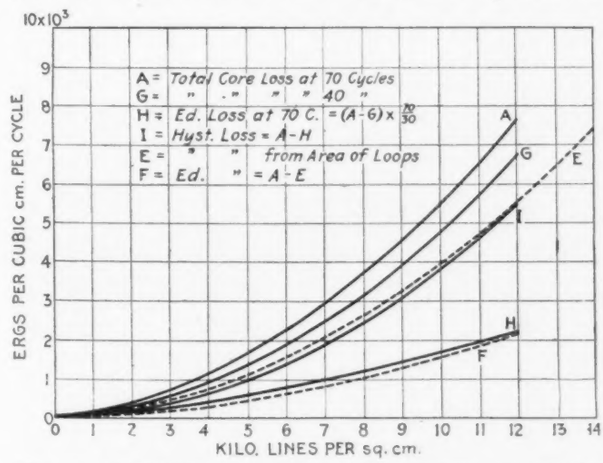
10x10³
A = Total Core Loss at 70 Cycles
G = " " " " 40 "
H = Ed. Loss at 70 C. = (A-G) x 70/30
I = Hyst. Loss = A-H
E = " " from Area of Loops
F = Ed. " = A-E
ERGS PER CUBIC cm. PER CYCLE
KILO. LINES PER sq. cm.

FIG. 4—OBSERVED AND CALCULATED CURVES OF TRANSFORMER CORE-LOSS

D and is seen to coincide almost exactly with A. However, this gives a value too small for the hysteresis and a value too large for the eddy-current loss. By subtracting curve E, the true value of the hysteresis loss, from curve A, curve F, the true value of the eddy-current loss, is obtained.

The two-frequency method of separation depends upon the fact that the energy loss per cycle due to eddy currents varies as the frequency, while the hysteresis loss per cycle is independent of the frequency. This is equivalent to saying that the power loss due to eddy currents varies as the square of the frequency and that due to hysteresis directly as the frequency, all data in this case being given in ergs per cubic centimeter per cycle.

Curve A, the total core loss per cycle at seventy cycles, is replotted in Fig. 4. Curve G is the total loss at forty cycles. Since the hysteresis loss is the same for both, their difference must be due to the eddy-current loss at the difference of the two frequencies, namely, thirty cycles. Therefore by multiplying the difference between curves A and G by $\frac{70}{30}$ the curve H, the eddy-current loss at seventy cycles, is obtained. Curve H is subtracted from curve A to get curve I, the hysteresis loss. Curves E and F are here replotted for the sake of comparison. The conformity is seen to be reasonably close.

By analysis it is found that curve E, the hysteresis loss, cannot be expressed by any simple equation, the exponent of $\mathfrak{B}$ being an increasing variable. The value 1.72 fits the curve very closely when used with

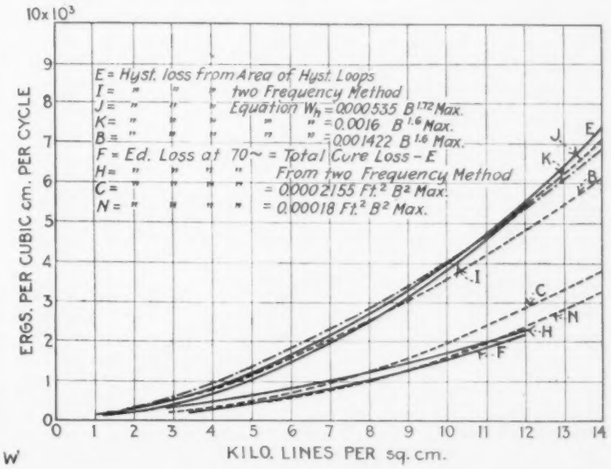
10x10³
E = Hyst. loss from Area of Hyst. Loops
I = " " " two Frequency Method
J = " " " Equation W_h = 0.000535 B^1.72 Max.
K = " " " " " = 0.0016 B^1.6 Max.
B = " " " " " = 0.001422 B^1.6 Max.
F = Ed. Loss at 70~ = Total Core Loss - E
H = " " " " From two Frequency Method
C = " " " = 0.0002155 Ft.² B² Max.
N = " " " = 0.00018 Ft.² B² Max.
ERGS. PER CUBIC cm. PER CYCLE
KILO. LINES PER sq. cm.

FIG. 5—OBSERVED AND CALCULATED CURVES OF TRANSFORMER CORE-LOSS

the coefficient 0.000535. The curve J in Fig. 5 has been plotted using these values. It coincides almost exactly with curve E during the greater part of its length. Using the coefficient 0.0016 with the exponent 1.6 gives curve K. It is interesting to note that in changing the exponent from 1.72 to 1.6 the coefficient must be tripled. By reducing the eddy-current coefficient from 0.000215 to 0.00018 curve N is obtained, which is in closer agreement with the experimental results.

In the two-frequency method of separation the eddy-current loss is obtained from the difference between curves H and G. This difference is small unless the two frequencies chosen are widely different, and a slight error in either of the curves or an error in measurement will be exaggerated in the eddy-current curve.

The ordinary student is apt to consider an empirical formula which he finds in a textbook as infallible, and when substituting in it will carry his results to three or four significant figures. It is hoped that the experiment here outlined will help to teach him the need of caution and judgment in accepting constants and formulas as well as give him an understanding of the principles involved.

Letters to the Editors

The Determination of Glare

To the Editors of the Electrical World:

Sirs:—In the article by Prof. L. R. Ingersoll on the measurement of glare in your issue of March 21 there appears to be a confusion of illumination with brightness, which has led to erroneous results in the use of his instrument.

In this instrument the surface to be examined is placed at the bottom of a box and illuminated by a translucent window at the far end of the box. This surface is viewed through a tube at the rear. In the case of purely specular reflection (black glass, for example) the apparent brightness of the surface is that of the illuminating window viewed directly multiplied by the reflecting power of the surface, or $I_0 R_1$. On the other hand, the brightness of a diffusely reflecting surface is the illumination at that surface multiplied by its diffuse reflecting power IR_2. I is approximately equal to the brightness of the window, I_0, multiplied by its area, A, divided by the square of its distance, d, from the surface illuminated, and again multiplied by the cosine of the angle of incidence, C, or $I = I_0 AC/d^2$.

Professor Ingersoll has apparently measured correctly the fraction of polarized light in the light from the surface, but in failing to distinguish between illumination and brightness has greatly overestimated the percentage of specular reflection. Approximately correct results may be obtained as follows: The apparent brightness of the surface due to its specularly reflected light is $S = I_0 R_1$; that due to its diffusely reflected light is $D = I_0 R_2 AC/d^2$. What Professor Ingersoll measured was $S/(S + D)$ instead of $R_1/(R_1 + R_2)$, the percentage polarization sought. In his instrument $A = 9$, $C = 0.73$ and $d = 11\frac{5}{8}$, all in inches; hence what he measured as 50 per cent glare is really only 4 per cent; 75 per cent is 12 per cent, and 25 per cent is really only 1.5 per cent glare, so that the error is serious.

P. G. Nutting, *Eastman Research Laboratory.*
Rochester, N. Y.

Water-Power Developments on Public Lands

To the Editors of the Electrical World:

Sirs:—In your issue of May 9, 1914, it is stated that I advocated, at a recent hearing before the committee on public lands of the House of Representatives, a federal tax of 25 cents per hp on all developments located on the public lands of the West. As this statement does not conform to my views in the matter, I shall be grateful if you will publish the following:

The purport of my testimony was that any federal tax or rental must inevitably become a charge on the consumer; that in case of general public utility service the producer is relatively indifferent as to federal tax so long as it is not made so large as to affect adversely hydroelectric service in competition with steam-electric service; that if members of Congress believe it wise to increase consumers' rates in order to provide additional revenue to the treasury, the explanation of the matter to the consuming public logically falls upon the members of Congress and not upon the power producers; that in the case of water-power sites developed for electrochemical, electro-metallurgical or other purposes requiring very cheap power, even a small federal tax would be highly detrimental, especially in view of the fact that the United States is obliged to compete for such industries with the very cheap water-powers of Norway, Sweden and other countries.

The proposal to tax at 25 cents per hp was made by a previous witness and referred to me on cross-examination. My reply was to the effect that if a federal tax must be imposed it should be sufficient to cover merely the cost of federal administration; that in my judgment 25 cents per hp would cover all these costs; that, in view of all the inevitable uncertainties in estimates of cost and productivity of water-power plants, any proposal financed on so narrow a margin that a 25-cent tax would become a significant factor would fail to constitute a reasonably safe investment and should therefore remain undeveloped.

Washington, D. C. M. O. Leighton.

System of Charges for Energy

To the Editors of the Electrical World:

Sirs:—I wish to call attention to some important omissions in the interesting letter of Mr. L. C. Tomlinson in your issue of April 11. He appears to claim that there are three elements entering into the cost of energy, namely, the demand, or maximum rate of consumption; the quantity, or consumption, and the time. The fact is, however, that the cost depends very largely on other elements.

The cost depends greatly on the distance from the point of supply and on whether the circuits are overhead or underground. The cost, further, depends on the density of customers; that is, on whether the supply of a given quantity of energy is delivered at a single point, in which case the cost is the lowest, or a large quantity is delivered as the total of a number of supplies of small quantities delivered at different points close together, or, finally, as the total of a number of small supplies delivered at widely scattered points.

Moreover, there are numerous other items that affect cost and must be considered, but I mention these in particular as some of the most important to show that demand, quantity and time are by no means the only elements that determine costs.

An important omission from Mr. Tomlinson's statement is the unfortunate but nevertheless true fact that the value of the service to the consumer must be considered whenever two or more consumers use the same investment or service. For instance, whenever several consumers use the same investment at different times of the day and year, or when there is any initial expense for supplying one customer that is not needed again for supplying a second customer, the cost of such investment or service must be divided between these customers. However, if the division of this cost between these customers results in making the price to either of them above the value of the service to that customer, that customer will not pay, and the total of this cost must be divided among only those customers that are willing to take the service and pay their share. Hence the price in any case of joint use depends on the value to the user.

No system of charges can be developed that does not, first, take account of the actual elements of cost and, second, when dividing up these elements of cost among different customers, take account of the fact that no customer will pay more than the value of the service to him, and that if any customer will pay anything for investment which would otherwise be idle, or for a service or product which would otherwise be wasted if he did not use it, then such payment will reduce the price to all the other customers even if it be less than some theoretical cost.

Boston, Mass. R. S. Hale.

Handling the Small Consumer in Europe*

Statistics from continental Cities showing how electricity for domestic purposes is furnished to the poorest inhabitants—Even the peasants are reached. By S. E. Doane

AT the beginning of the electric-lighting industry not only were the means for conversion of electric energy into light more incomplete and less efficient than to-day, but the price of energy itself was higher and electric illumination was decidedly a luxury. As the art advanced the cost of producing the energy was gradually reduced, and at the same time, owing to the progress of the lamp industry, the transformation of electricity into light became more and more economical, the lamps becoming at once more efficient and less expensive. Thus many causes co-operated to cheapen the cost of light to the ultimate consumer to an unthought-of degree.

FIG. 1—COURT OF POPULAR BUILDING IN MILAN, ITALY, SHOWING OVER TWENTY CUSTOMER CONNECTIONS

About six years ago, when the high-efficiency incandescent lamp began to be used in earnest, apprehension and uneasiness seized many central-station men on this side of the Atlantic as well as on the other. It was believed that a 70 per cent reduction in the watt-hour consumption for a certain number of candle-power-hours would mean a similar reduction of revenue. Experience has shown, however, that the increased demand for light by the individual consumer, as well as the increase in the number of consumers, which was brought about by the lowered lighting costs offset to a large extent the reduction of income per candle-power-hour. It is now acknowledged that the reduction in the cost of producing electric light incident to the use of the metal-filament lamp placed electricity in a position to compete with gas. The situations happened to run nearly parallel, inasmuch as not only had the price of gas gradually decreased as the methods for making it were improved but the efficiency of utilization of gas in the production of light was also improved by two comparatively sudden steps, namely, the invention of the Welsbach mantle and the introduction of the inverted burner, which two steps may be compared to the introduction of the tantalum and tungsten lamps respectively. Both gas and electricity—especially the latter—can now compete successfully with petroleum, the rays from which thus far have been considered the "poor man's light."

In the case of electricity, however, experience seemed to show that under existing conditions, although the consumer could be served at the same or lower cost to him than with other illuminants, the small consumer was unprofitable to the central station. Very small consumers would use so few kilowatt-hours that the revenue collected from them would not even cover such expenses as meter reading, accounting, billing and collecting, in addition to the maintenance of the meter and the interest and depreciation on it.

The Small Customer

One of the most interesting results of the writer's trip to Europe originally undertaken for the purpose of studying the inexpensive methods of wiring developed and used abroad—was the discovery that European central stations have found a way of making the

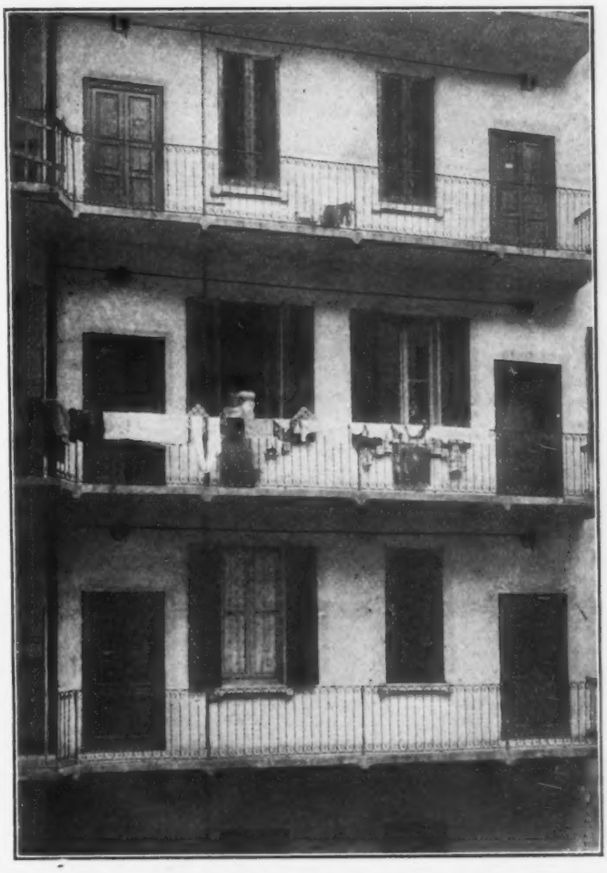

FIG. 2—SIX-CUSTOMER CONNECTIONS IN POPULAR HOUSES IN MILAN, ITALY

*This article is published by arrangement with the National Electric Light Association and will be reprinted for the Philadelphia convention as an appendix to the report of the committee on the wiring of existing buildings, R. S. Hale, chairman.

small customer profitable. Not only do the managers there appreciate the small consumer, but a very large and ever-increasing number of central stations are making every possible effort to attract this class of consumers to their lines.

In some cases the original motive for soliciting the small consumer was to thwart municipal or competitive

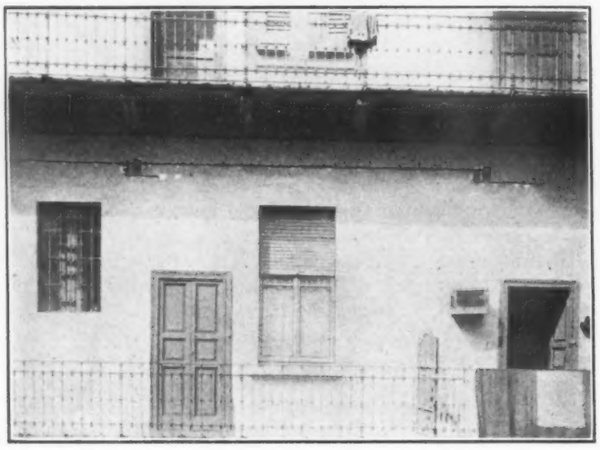

FIG. 3—TWO-CUSTOMER CONNECTIONS IN POPULAR HOUSES IN MILAN, ITALY

developments. With a vast majority of the possible users of electric service connected in circuit the use of the unconnected individual as a political asset of the demagogue politicians was greatly diminished. After the movement toward the acquisition of small customers (residences, small shops, etc.), had been started, the central stations found that this class of business, instead of being a financial burden, was a very valuable asset, if handled in the proper way.

Intensive Development of Latent Market

The reason that this movement started earlier in Europe, particularly in Germany, may be because in the comparatively thickly settled districts the territory

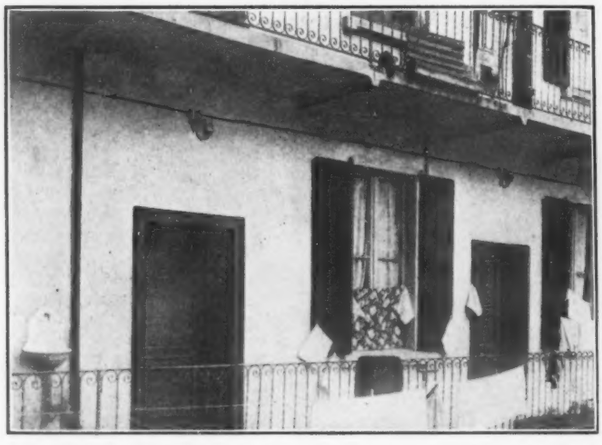

FIG. 4—SERVICE CONNECTIONS IN MILAN, ITALY

is limited and the population is not always growing as rapidly as in the United States, where in some places the increase of population alone is enough to keep the central station busy connecting up consumers that have moved from older communities. Consequently the central stations in Germany and other countries of Europe had to reach out for the smaller customers and had to develop methods to make them profitable, in order to increase their own incomes.

Another reason may be found in the competition between electricity and gas, which is severer in Germany than in any other country. Cause and effect were here probably working in a circle. In Germany, as well as in the rest of Europe, when electricity was introduced about twenty or twenty-five years ago, gas had already been established to a greater extent than in the new and rapidly growing American cities, and this may be one of the reasons why the competition between gas and electricity is so much keener there than in the United States, where gas and electricity have had their respective territories more nicely defined from the beginning.

When through great improvements electric light began to cheapen, the gas companies in Europe saw their territory encroached upon by the electric central-station companies, and, in order to compensate for the losses inflicted upon them by electric competition, they reached out for the smaller consumer. In general, therefore, it was the gas companies that started this campaign by making gratuitous installations, installing prepayment meters, etc., and the electric light companies followed. In some places the central stations have been leading the way with the gas works following closely after.

According to a most prominent expert on methods of developing the use of electricity, Director E. Wikander, of Berlin, to whom the writer is indebted for many valuable statements, it is the admitted intention of the gas industry to equip all small residences in the cities with gas pipes and prepayment gas meters as quickly as possible. This policy of the gas companies and the gratifying financial returns resulting therefrom have prompted the electric-light companies to adopt similar methods.

Apart from the direct financial gain secured through the small consumers' business, it has been observed that the medium-sized customer, who represents the middle class, is attracted automatically by a reduction in soliciting expense. This is easily understood if one imagines a man of the middle class, for instance, hear-

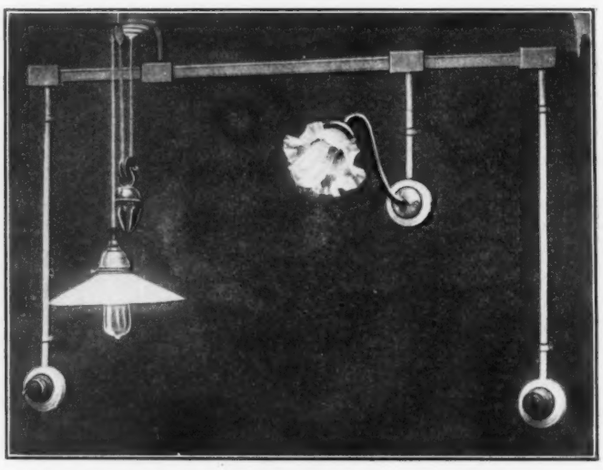

FIG. 5—FITTINGS USED IN MILAN, ITALY

ing from his maid that his poorer neighbor has electric light at home, whereas he himself is still using inferior illumination. It is for this reason that the solicitors of some electric-light companies are being paid more for the small consumers acquired than for larger ones, though, of course, the effort and trouble may also be greater.

Inexpensive Wiring

For several years the writer has been particularly interested in the inexpensive wiring methods used in Europe, and he finally decided that the progress there in handling very small customers had been such as to warrant a study of their methods. More than one year ago one of the writer's assistants, Mr. Eisenmenger, went to Europe to study the small-customer situation, preparatory to the writer's own visit to Europe last spring. It was quickly found that chief interest centered in Germany and some places in Italy, Austria and Switzerland having followed rather than led, and developments in France having been quite backward. As regards England, time did not permit of covering the ground fully, but enough was seen and heard to indicate that Germany offered the best field in that particular matter. Circular-letters were sent to 660 central stations (mostly in Germany), asking particularly as to their experience in obtaining and handling small customers. Approximately 300 replies were received, about 200 of which contained something of interest.

A number of the central stations which seemed most interesting from this point of view were visited in order to get the ideas of their managers. Interviews were also held with other men prominent in the industry who, although not connected with any one particular central station, still were in a position to know the trend of the times in this respect, and it is a pleasure here to express appreciation for the kindness everywhere received and for the amiable readiness with which the investigations were aided. Mention should especially be made of Mr. C. F. v. Siemens and Dr. O. Feuerlein, of the Siemens & Halske Aktien Gesellschaft, Berlin; Mr. E. Wikander, director of the Geschäftsstelle für Elektricitäts-Verwertung (Society for Electrical Development), of Berlin, and Dr. G. Siegel, of the Allgemeine Elektricitäts Gesellschaft, also of Berlin, for their kind assistance and for the information furnished by them.

In deriving the maximum benefit for the central station from the small consumers two distinctly different problems are involved: (1) making the small customer a profitable one, and (2) soliciting the business of the small customer.

These problems have various features in common. Some of the details of the solution of one contribute toward solving the other. It is impossible, therefore, in treating this subject to distinguish nicely between the two and maintain a thorough and perfect classification of the means of their solution.

The small consumer can be made profitable by (a) lowering and holding down in general the cost of furnishing him with electricity, in addition to reducing the capital necessary therefor, and (b) regulating the income by the application of proper rates so that financial losses from individual consumers are avoided and a decided financial advantage for the central station from every consumer is obtained. The former can be accomplished by simplifying and cheapening the system in use for accounting, billing and collecting, as, for instance, by the adoption of "department-store methods." The regulation of the income does not necessarily imply an increase of cost of light to the consumer, but rather a reduction.

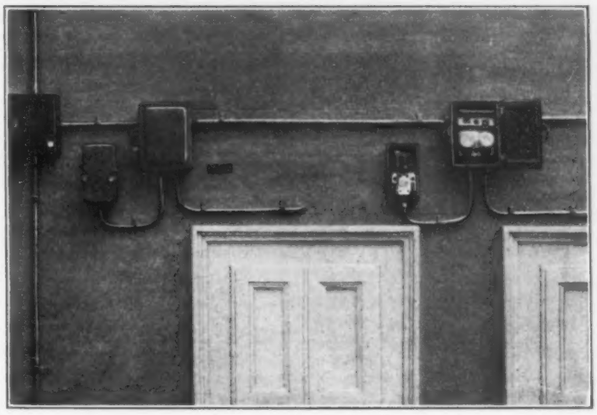

FIG. 7—RISER, CABINET, CUT-OUT AND EXCESS INDICATOR IN USE IN MILAN, ITALY

In soliciting the small customer the use of all sorts of advertising methods, canvassing personally and by printed matter, etc., is contemplated.

Proper rates form one of the most important means of making the small consumers' business as profitable as possible.

Another group of methods which fall under the heading "Soliciting" are the different means used by electric-light companies to finance the cost of installation for the prospective customer. The greatest obstacle to the acquisition of very small customers from the consumer's standpoint is the initial expense for wiring and fixtures. Inexpensive wiring methods relieve the customer either directly (in case he pays for his installation in cash) or indirectly (in case the money is advanced by the electric-light company).

To give some comprehension of what the electric-light companies are doing in Europe to make the business of the small consumer profitable, reports of what is actually being done in typical cities are appended. No attempt is made to give a detailed account of what was found in every single place. Data on the most interesting installations, however, are given in tabular form.

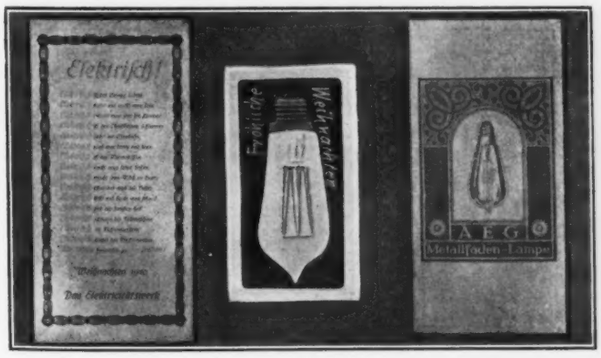

FIG. 6—HONEY CAKE (IN CENTER) AND CARTON DISTRIBUTED IN WERDAU

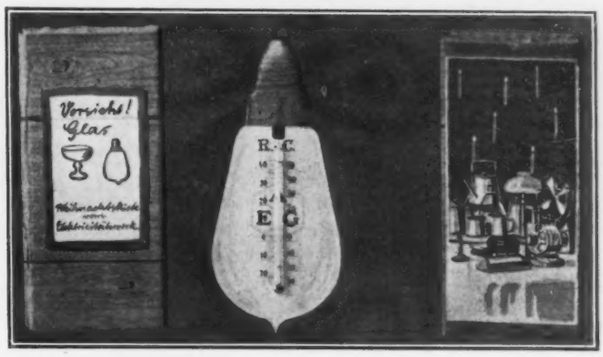

FIG. 8—THERMOMETER AND CARTON DISTRIBUTED IN WERDAU

Accounts of inexpensive wiring schemes obtaining in Europe are also included.

Wiring at Central Station's Expense at Strassburg

One of the first central stations to apply successfully methods of financing small customers was the electric-light company at Strassburg, Germany. The conditions are essentially as follows: Only houses already completed are wired under this system, and then only in installations of from one to four lamps. The wiring for the first outlet, excluding the fixture, is installed at the expense of the electric-light company without any obligations on the part of the customer other than a contract to pay an annual minimum bill for energy of $4.30 for six years at the ordinary rate of 9.6 cents per kw-hr. For the wiring of the second, third and fourth outlets 6 cents is to be paid per month per lamp for six years, after which time the electric-light company waives the right of ownership. In any case a meter rent of 6 cents a month is also charged. Before any house is connected there must be at least four customers applying for connections. It is evident therefore that this system of wiring applies only to tenements and apartment houses, of which, according to the German way of city building, the city of Strassburg proper, as well as almost all other Continental cities, chiefly consists.

Wiring Village Houses

The territory of the central station comprises the city of Strassburg itself (178,000 inhabitants) and also 166 adjacent villages, with a total population of 185,000. The methods for connecting the small houses in these villages, where there are no apartments or tenements, but one-family houses, vary slightly. The lighting company advances the money for wiring houses to the prospective customer and collects the amounts from him in instalments within from one to three years. The number of instalments is arranged to suit the convenience of the consumer, and in many cases the time of payment is fixed at harvest time, since the occupation of the inhabitants is largely agricultural.

Relations with Wiring Contractors in Strassburg

The electric-light company does not do any wiring itself. It has agreements with the contractors, who make installations at the fixed unit prices given below.

In all ordinary cases these figures give the contractor a reasonable profit, and in exceptional cases or under particular conditions, should this not be so, the contractor has to deal directly with the consumer for the difference. The office work resulting from these standardized installations is therefore reduced to a minimum. The electric-light company encourages not only the prospective customers by advancing the installation costs but also the contractors. The latter receive on account a certain allowance of wiring material if desired, and immediately after an installation is

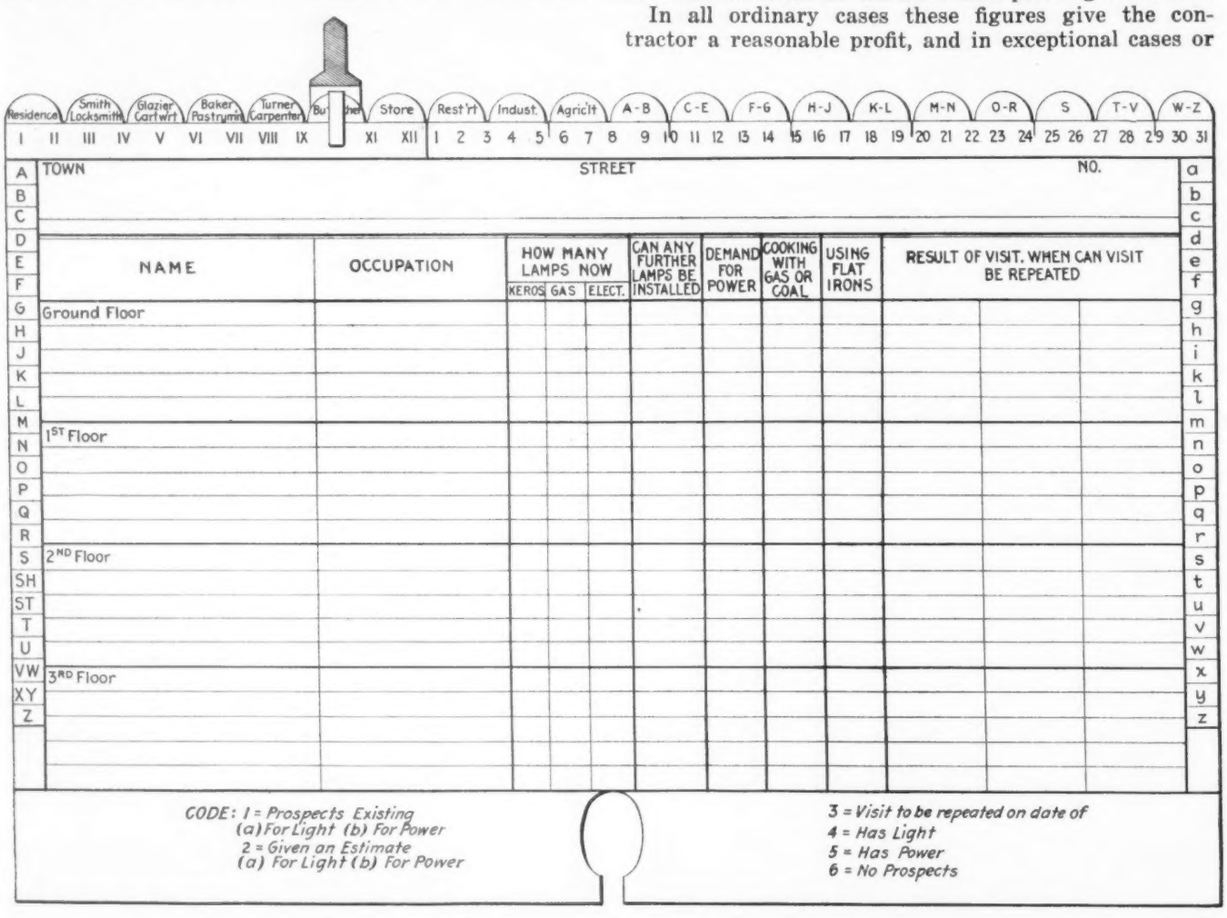

FIG. 9—SOLICITING CARD USED AT WERDAU (TRANSLATED)

UNIT PRICES FOR WIRING IN STRASSBURG

City		Country	
Riser per foot	$0.087	Outlet in dry places	$3.00
First outlet	3.60	Outlet in moist places	4.00
Second outlet	3.10	Additional for a two-way switch	1.45
Third outlet	2.90		
Fourth outlet	2.40		

finished the bulk of the contract sum (about 75 per cent) from the electric-light company. The balance is paid immediately after the installation has passed inspection.

Results Obtained in Strassburg

The following statistics, for which we are indebted to the managing director of the company, Mr. Alfred Loewe, illustrate the results obtained by these methods."[1]

In January, 1913, in the city district, with 165,000 civilian inhabitants, 27,300 meters were installed, or sixty-eight meters to every 100 households, or one meter to every six inhabitants. In the rural part of the territory supplied, having 185,000 inhabitants, there were 20,000 meters installed, or one meter to every nine and one-fifth inhabitants. The number of installations paid for on the instalment plan in the city (and a few places in the rural territory) was not less than 13,700, which shows the great importance of the latter type of installation and also of the small consumer (four lamps and under). The income per inhabitant per annum was $4.60 in the city district and $1.20 in the country district. The number of kilowatt-hours sold was 106 and 26 respectively, including that for railway and motor service (kilowatt-hours for railway service are approximately 20 per cent of the total kilowatt-hours consumed). The number of incandescent lamps installed per inhabitant was 2 in the city and 0.74 in the country district.[2]

This system has been in use in Strassburg since 1909, and Director Loewe observed in 1911 that gas as a competitor of electricity was vanishing and that in almost every case it was even possible to compete with kerosene.

The average yearly income from instalment installations is $7.64 for energy plus 72 cents for meter rent, making a total of $8.36.

The number of customers wired on the partial payment plan was in January, 1910, 1460; January, 1911, 5070; January, 1913, 13,700.

In April, 1911, when 5570 installations were connected under this system, it was found that 205 consumers did not pay the instalments due. The larger number of cases in question were caused by removals, and this loss of about 3.7 per cent in temporarily empty apartments was reduced as the apartments were rented again, so that only a very small loss has to be taken into account.

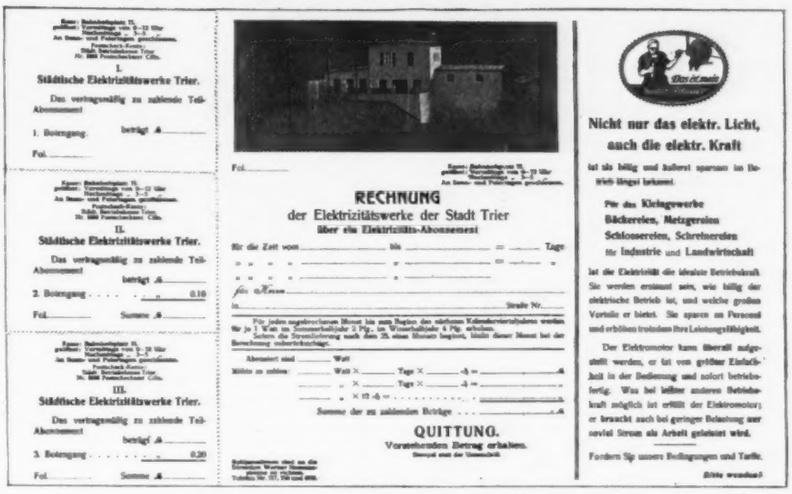

FIG. 10—FORM OF FLAT-RATE BILL USED IN TRIER

The financial side of this instalment wiring system can be appreciated from the following figures: Installations to the number of 5573 required a capital of $73,400, excluding the service connections, which cost $33,600. It is assumed that the expense of the service connections will be amortized gradually as ordinary capital invested, whereas the interior wiring will be repaid within the six years of the consumer's contract. The consumers are paying, according to the terms of the contract, during the six years (as monthly instalments for the second, third and fourth outlets) $51,000, so that $22,400, or $3.730 a year, must be written off. The income for energy from these rental installations was about $40,000 per annum, and the benefits of this system correspond to a discount of about 10 per cent to the consumer (at the straight meter rate of 9.6 cents per kw-hr.).

The statistics of the Strassburg central station show that of 500 partial-payment installations only 37 failed to consume the yearly guarantee of $4.30 and therefore had to make a supplementary payment for energy not consumed. The same statistics also show that the average number of lamps in these 500 installations was about 3.1. Since most deferred-payment installations have been ordered from the electric-light company with a connected load of only two lamps, this figure shows that many consumers have made extensions at their own expense.

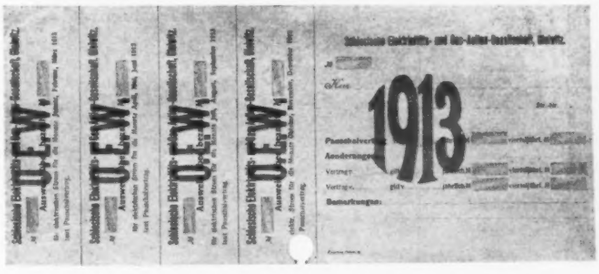

FIG. 11—QUARTERLY BILL FORM USED IN GLEIWITZ, SILESIA

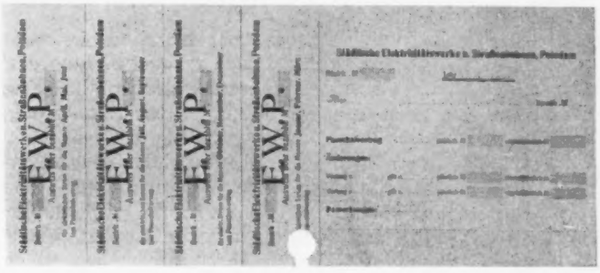

FIG. 12—QUARTERLY BILL FORM USED IN POTSDAM, GERMANY

[1] In reviewing these statistics it should be understood that in Germany, as well as in the rest of Europe, electric illumination, when it came to be introduced about twenty or twenty-five years ago, found gas lighting more firmly intrenched than in the newer and generally more rapidly growing American cities, and therefore it had and is still having a harder fight against gas than in America.

[2] The average corresponding figure for forty-four German cities selected at random was found to be 0.55 lamp per inhabitant.

The last annual report of the central station at Strassburg showed a dividend of 11 per cent.

It was found that in all other cases where small customers were being handled systematically and profitably an exclusive or optional flat rate was being applied for that class of customers, together with a meter

Karte M ____ für das Jahr 19__ Bezirk M ____

Quittungsbogen I. bis XII. Rate

über Monatsraten für Beisteuer und elektr. Strom laut Pauschalvertrag.

Für Herrn ____ Straße No. ____

Laut Abkommen vom: ____ Monatl. zu zahlender Betrag a. Beisteuer ____ M. ____ Pf.

Die Anlage kam in Betrieb am ____ 19__ b. Pauschale ____ „

Die Raten begannen mit dem Monat ____ 19__ zus.: ____ M. ____ Pf.

XII. Rate. Ausweis über bezahlte M. ____ für den Monat ____ 19__ laut Abkommen über Beisteuer und Pauschale. Städtische Elektricitätswerke u. Straßenbahnen, Potsdam.

XI. Rate. Ausweis über bezahlte M. ____ für den Monat ____ 19__ laut Abkommen über Beisteuer und Pauschale. Städtische Elektricitätswerke u. Straßenbahnen, Potsdam.

X. Rate. Ausweis über bezahlte M. ____ für den Monat ____ 19__ laut Abkommen über Beisteuer und Pauschale. Städtische Elektricitätswerke u. Straßenbahnen, Potsdam.

IX. Rate. Ausweis über bezahlte M. ____ für den Monat ____ 19__ laut Abkommen über Beisteuer und Pauschale. Städtische Elektricitätswerke u. Straßenbahnen, Potsdam.

VIII. Rate. Ausweis über bezahlte M. ____ für den Monat ____ 19__ laut Abkommen über Beisteuer und Pauschale. Städtische Elektricitätswerke u. Straßenbahnen, Potsdam.

VII. Rate. Ausweis über bezahlte M. ____ für den Monat ____ 19__ laut Abkommen über Beisteuer und Pauschale. Städtische Elektricitätswerke u. Straßenbahnen, Potsdam.

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II. Rate. Ausweis über bezahlte M. ____ für den Monat ____ 19__ laut Abkommen über Beisteuer und Pauschale. Städtische Elektricitätswerke u. Straßenbahnen, Potsdam.

I. Rate. Ausweis über bezahlte M. ____ für den Monat ____ 19__ laut Abkommen über Beisteuer und Pauschale. Städtische Elektricitätswerke u. Straßenbahnen, Potsdam.

FIG. 13—MONTHLY FLAT-RATE CARD USED IN POTSDAM

rental. The central station at Strassburg furnishes an example of the excellent results which can be achieved with a pure meter rate. It should be emphasized, though, that the company requires one 60-watt lamp to be installed and does not encourage the use of any smaller lamps.

Of interest are the special agreements which the electric-light company at Strassburg has made in order to introduce electric light into such groups of laborers' residences as are under the administration of building corporations. Thus, in a garden city near Strassburg, where up to now 500 apartments, renting at from $4.50 to $6 a month, have been erected, electricity is used exclusively and 14,000 lamps have been installed. The building company has guaranteed an income of $3.50 per flat a year. In another district, in a similar way, about 800 apartments of one, two or three rooms each have been furnished with electric light.

Tenement House Wiring in Milan, Italy

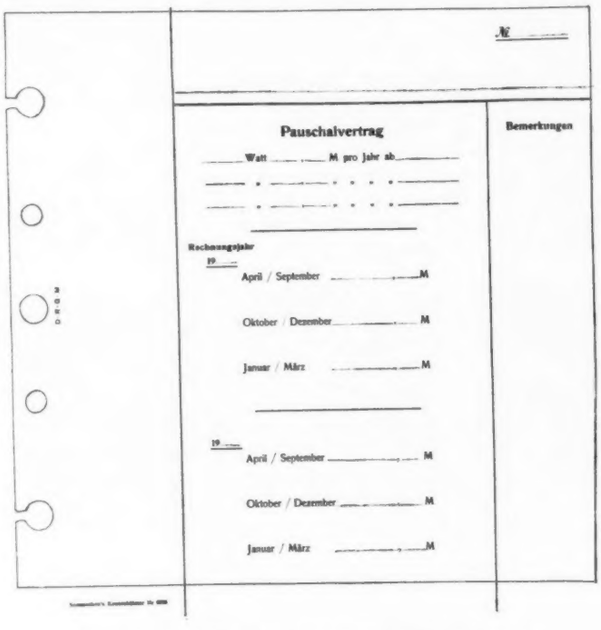
Another most interesting system for connecting small consumers to the lines is being used by the Edison Company of Milan, Italy.[3] Milan is an industrial and growing city of about 650,000 inhabitants. The laboring classes live, as elsewhere, in one, two or three rooms, in large tenement houses. The typical home is made up of two rooms and kitchen. The rent per room is between $25 and $30 per annum. The average income of the family head is between 80 cents and $1 a day. Figs. 1 to 4 show typical views of tenement-house installations.

Deferred Payment and Flat-Rate Plan

It would be hopeless, of course, to attempt to introduce electric lighting to this class of the cost of installation without taking the burden of the cost of installation from their shoulders. At the same time, it is also evident that the consumption of such consumers would be so small that the outlay for a watt-hour meter for each consumer and the expense of billing and collecting could hardly, if at all, be covered.

The controlled flat rate was therefore introduced for such consumers in October, 1909, with a simple current-limiting device costing about $1. No meter is used at all, and the flat rate includes the energy used as well as the rental of the installation and simple fixtures.

Very small lighting units were installed, so as to keep the cost of lighting very low. Tungsten-filament lamps of 10-watt, 20-watt and 30-watt ratings are installed at a cost to the customer of 16, 24 and 34 cents respectively a month. This price also covers the charges for using the wiring owned by the company. In order to make conditions as favorable as possible for customers separate rates are given for lamps wired with a change-over switch, so that either one or the other lamp can be burned, at the choice of the tenant, but never both at the same time. The monthly charge for a set of these lamps is only 4 or 5 cents higher than for one single lamp, viz., 20, 29 and 39 cents for 10-watt, 20-watt and 30-watt lamps respectively. This additional price is for any additional energy consumed


M ____

Pauschalvertrag

Bemerkungen

____ Watt ____ M pro Jahr ab ____

Rechnungsjahr

19__

April / September ____ M

Oktober / Dezember ____ M

Januar / März ____ M

19__

April / September ____ M

Oktober / Dezember ____ M

Januar / März ____ M

FIG. 14—LOOSE-LEAF ACCOUNT USED IN TRIER

and the expenses of additional wiring. Supply and renewal of lamps are, however, not included. The customer buys his own lamps and in that way very soon learns that to waste energy is disadvantageous. Lamps are sold at from 20 to 25 cents each to the consumer by the electric-light company. They may be purchased elsewhere, but the lamps used must be "one watt per

[3] Through the courtesy of Mr. J. W. Lieb, of the New York Edison Company, letters of introduction were obtained to Mr. G. Semenza, chief engineer of the Milan Edison Company, who extended a very kind reception and gave very valuable information. Valuable assistance was also rendered by Mr. Renzo Norsa, of Milan, in compiling data about the Milan methods.

hefner candle" lamps. The current limiter is adjusted to the full connected load—counting a couple of lamps so connected that each may be controlled separately but not simultaneously as one lamp. The consumer can therefore switch on all of his lamps simultaneously, the object of the current limiter being only to prevent

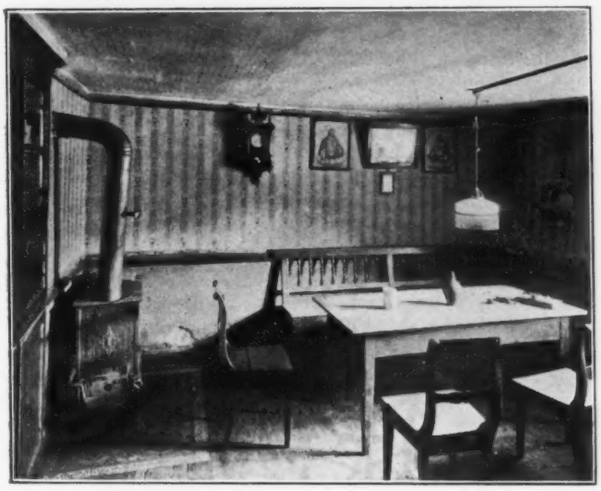


FIG. 15—ELECTRICITY IN PEASANT'S HOME IN TRIER

the use of larger lamps than contracted for. Bills are payable in advance.

Relations with Contractors in Milan

Before the wiring of these so-called "popular houses" is started the owner signs a contract permitting the company to install and maintain the wiring for a period of fifteen years. Only the wiring of the riser and of the main distributing circuits is done by the company itself. The inside wiring is done by the contractors at fixed prices per outlet, by a system similar to that used in Strassburg. The prices paid by the company are $2 for each outlet and $4.20 for each pair of lamps so controlled that both cannot be lighted at the same time, including switches and fixtures. Open wiring is extensively used in ordinary residence work in Milan, but the lighting company realized that the proper upkeep of the installations in workingmen's houses would not be possible unless all the wiring were protected by tubing or molding, on account of the fact that tenants move frequently, that they belong to the poorer classes, etc. A typical two-room installation may be considered as made up of two lamps, one for each room. Fig. 5 shows the materials and fixtures used. The wires on the walls close to the ceiling are incased in wooden molding, and the leads to the fixtures and to the switches are in impregnated paper tubes with a thin metal-sheet covering.

Results Obtained in Milan

The following statistics regarding the above described popular lighting business of the Edison Company of Milan have been kindly furnished by Mr. Bertini, general manager of that company:

DATE: Dec. 31, 1912.

Buildings supplied	1,638
Customers	25,016
Total lamps connected	45,945

Lamps to the number of 12,636 are in pairs, only one of which can be lighted at a time. The number of lamps which can be lighted simultaneously is, therefore, 33,309. Of these 33,309 lamps:

	Kw
13,584 are 10-watt lamps	135.84
18,420 are 20-watt lamps	368.40
1,305 are 30-watt lamps	39.15
The corresponding total connected load is	543.39

In addition, there were 4750 flats (with 7834 lamps), corresponding to about 100 kw, which were wired but which were not rented.

The total connected load amounted, therefore, to about 650 kw. (This increased during the year 1913 to about 750 kw.) The capital invested for installations in popular houses (in December, 1912), was approximately $300,000, or about 7 per cent of the total investments of the company for generation, transmission, transformation and distribution, since the latter were valued at over $4,400,000. From the data above the following averages have been derived:

Average number of customers per building (25,016÷1638)	= 15
Average number of lamps installed per customer (45,945÷25,016)	= 1.83
Maximum number of lighted lamps per average customer (33,309÷25,016)	= 1.33
Total connected load per average customer in watts[4] (543.39÷25,016)	= 21.71
Total investment for installation per customer approximately (300,000÷25,016)	=12.00

The company pays the local wiring contractors the following rates for the wiring in the rooms, the fixtures and the switches:

Each individual lamp	$2.00
Each pair of lamps so controlled that only one can be lighted at a time	4.20

Cost of Wiring in Milan

The cost of installation per customer is about as follows:

FIG. 16—INTERIOR OF TRIER COTTAGE

Riser and main distributer circuits, including auto transformer[5]	$5.50
Current limiter, fuses and connection	2.00
Wiring for one and one-third outlets at $2 an outlet	2.70
Wiring for one-half specially controlled lamps, at $4.20 per pair	1.05
Testing of the installation	0.40
Total average cost of installation per customer to company	$11.65

[4]It is particularly interesting to note the very low wattage demand of the average customer of that class of business.

[5]When the system was first installed tungsten lamps were not yet manufactured for the voltage of the Milan system, which is 160 volts, and therefore the company decided to use 40-volt lamps with auto transformers.

This figure checks fairly with the figure of $12 given above.

The monthly gross income from this class of business amounted in December, 1912, to about $7,600, or about $14 per month per connected kilowatt, not counting houses wired but not rented. The cost of installation per kilowatt from the above figures (including instal-

FIG. 17—ELECTRICITY IN HUMBLE TRIER HOME

lations not rented at the time) would be $300,000 ÷ 650 = $460.

These figures seem to indicate a gross yearly income per kilowatt connected from this kind of business as follows:

(a) Including flats not rented: $7,600 × 12 ÷ 650 = $140. (b) Not counting unrented flats: $7,600 × 12 ÷ 543 = $168.

This, of course, must also cover the fixed charges on the money invested in the installations in the popular houses themselves, as given above.

It is the practice of the company to obtain a check on the energy consumption of such consumers as are supplied under the controlled flat rate by installing a certain number of meters and also maximum-demand indicators of the Wright type. The result of a test made on 154 buildings in that way showed that the use of the maximum demand amounted to 2270 hours a year.

Improvements Considered in Milan

Experience with this system during the space of four years has shown the desirability of some improvements. A plan now being considered and which may be adopted in the future is to have the house owner refund to the company the initial cost of wiring in instalments, the wiring becoming in the end the property of the house owner. From Table III it will be seen that this system is already largely used in Germany, where it is showing excellent results. In that case the landlord will materially assist the company in supervising the installations so that maintenance expenses will be considerably cut down. The repayment plan will also reduce the financial burden of the company.

The method of collecting bills is also open to improvement, and it has been suggested that since both the rent for the flat and the electric-light charges are payable monthly, the owner of the building be required to collect the monthly charges for lighting, together with the rent of the rooms, in return for the financial aid he received from the company in the cost of the installation. (See under Gothenburg.) This will reduce the expense of account keeping and rendering of bills, as well as the expenses of collecting, which are comparatively high, the latter being further increased by the fact that it is often necessary for the collectors to call during evening hours or on holidays in order to find the tenants at home. The collectors now receive a certain percentage of the amounts they collect. In spite of the possibility of improvements in handling this kind of business, the system has proved very effective in popularizing the use of electricity among the poorer classes. The municipal central station of Milan, which is competing with the Edison Company, is employing the same system and has also about 24,000 customers in workingmen's buildings, with 47,000 lamps. The Edison Company says in its latest (1912) annual report the following: "The notable augmentation of $86,000 is in large part due to numerous installations made in the 'popular houses' for furnishing light. . . . We have been obliged to discourage the acceptance of new applications in the 'popular houses' for a time, with a view to keeping the business within bounds, and we are now contemplating a gradual assimilation of more of this business, with some modification of the conditions under which the installations are made."

Central Station at Werdau, Saxony

The central station at Werdau, Saxony, belongs to a large company, the Elektricitäts-Lieferungs-Gesellschaft of Berlin, closely allied to the Allgemeine Elektricitäts Gesellschaft, which is operating a number of lighting stations in Germany on very progressive lines. That at Werdau may be considered as representative of these central stations.

Werdau is a city of roughly 25,000 inhabitants. The central station, however, is also supplying electricity to about fifty surrounding villages, so that the number of inhabitants served approximates 100,000. Werdau, being situated in an industrial district, has a large number of families of the laboring class who are using electric light exclusively, owing to methods of facili-

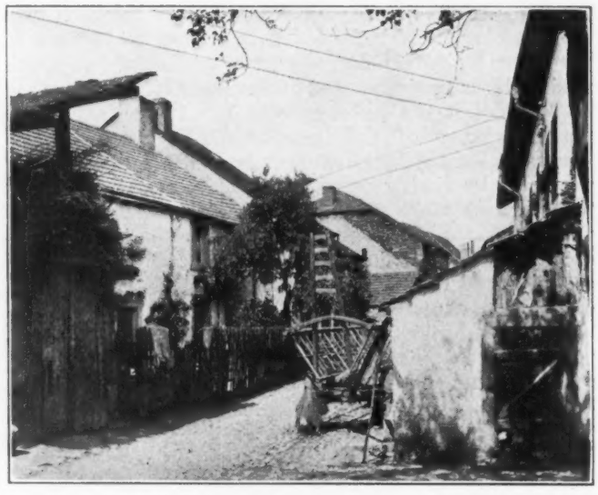


FIG. 18—PEASANT COTTAGES IN TRIER EQUIPPED FOR ELECTRICITY

tating the use of electricity. As in most other cases, the controlled flat rate (current limiter), with or without methods for financing the small customer, is found to be particularly useful.

The monthly rates for residences are 11 cents per 16-cp lamp, 18 cents per 25-cp lamp, 24 cents per 32-cp lamp, etc.

If the flat-rate consumer pays for his installation, he has to buy the current limiter from the central station, at a cash price of $1.80, but if a customer desires to make instalment payments he is generally accommodated

Rental Installations at Werdau

The wiring also is installed at the expense of the central station, if the customer so desires. In that case he has to pay a supplementary charge of 3.6 cents a lamp a month as rent for the installation, which includes simple fixtures but not the lamps themselves. The consumer also must contract to continue these payments for at least three years. This amount of 3.6 cents a month is based on the assumption that 15 per cent of the average selling price of the installation shall be paid off every year by the rent. The average selling price has, therefore, been assumed as being $2.90 a lamp outlet. Flexible twin cord is chiefly used in wiring these outlets. Most customers, of course, are using lamps a longer period than the contract calls for. In the few cases where the customers have moved and refused to continue the payments the central station has not found it worth while to bring any action against them.

The customer has to pay for maintenance and repairs and for the insurance on the wiring. He does not, however, acquire the ownership of the installation by paying the rent, as is done in most other similar cases in Germany.

According to the literal wording of the conditions for connection of flat-rate installation, not less than two lamps will be connected per consumer, but, as a matter of fact, the central station also frequently connects one single lamp. Although a single 16-cp lamp at 11 cents per month does not bring any profit, experience has shown that a considerable number of customers start with one lamp and then gradually work up to a larger number.[6]

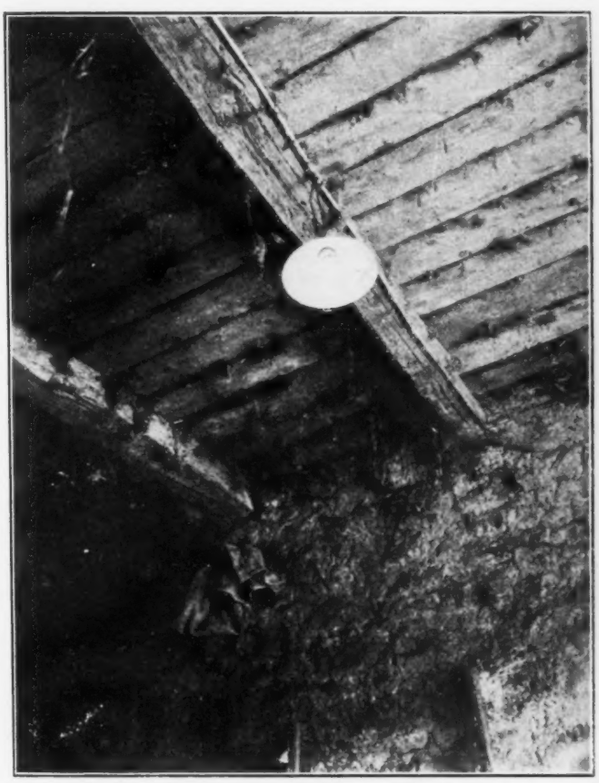
Those customers who have at least six lamps can also be charged under the Hopkinson rate scheme (demand charge plus running meter charge) and can get their installation made at the expense of the central station, at a monthly charge of 3.6 cents a lamp.

Tungsten Lamps Prescribed

Under both rates, the flat rate and the Hopkinson rate, the exclusive use of tungsten lamps is expressly prescribed, and the customers who have to pay for their lamps are particularly warned that use of the lamp reduces its life.

The central station at Werdau is also very progressive and thorough in its methods of soliciting. A very complete card-filing system is kept, every house in the city and the surrounding villages having a card of its own (size 8 in. by 5 in.) of the type shown in Fig. 9.

Of the semicircles on the upper edge of the card, the first ten on the left side indicate the occupations of the inhabitants of the respective houses, the first semicircle indicating residences, the second smiths and locksmiths, the third glaziers. The ten semi-circles on the right-hand side of the upper edge are given over to the initials of the street names. All the semicircles which do not apply to the respective building are cut off the card in the ordinary way, so that the card system becomes self-indexing. The cards for all the buildings in streets beginning with "S," for instance, or for all the locksmiths, can be taken from the file for inspection without loss of time. Below this row of semicircles there is a horizontal row of figures to indicate a date for purposes to be stated later. On the left part of this second horizontal row twelve roman



FIGS. 19 AND 20—TWO VIEWS OF PEASANT'S BARN LIGHTED WITH ELECTRICITY IN TRIER

[6] A similar experience has been recorded for Strassburg and many other places.

TABLE I—EFFECT OF FLAT RATE ON VILLAGES SURROUNDING TRIER

CONNECTIONS IN VARIOUS RURAL DISTRICTS OF SUPPLY CAUSED BY THE FLAT RATE WITH LIMIT DEVICE PARTLY WITH ASSISTANCE OF A WIRING SUBSIDY

VILLAGE NO.	RATES	VILLAGE CONNECTED SINCE YEARS	NUMBER OF CONNECTIONS IN %		REVENUE FROM PRIVATE LIGHTING PER INHABITANT PER YEAR		FLAT RATE INTRODUCED SINCE	SUBSIDIARY WIRING INTRODUCED
			PREVIOUS TO FLAT RATE AND TO SUBSIDIARY WIRINGS	NOW	PREVIOUS TO FLAT RATE AND TO SUBSIDIARY WIRINGS	NOW		
1	10.8 ¢ per kw-hr. + 12 ¢ per mo. meter rent or double rate*) 10.8 ¢ / 4.8 ¢ per kw-hr. Ave. price 7-7½ ¢ per kw-hr. meter rent 36 ¢ per month	8	10	31	$ 0.32	$ 0.67	Oct. 1st 1911	No Subsidy
2		3	19	42	0.45	0.65		
3		3	11	27	0.37	0.55		
4		3	10	44	0.34	0.60		
5		3	20	29	0.45	0.55		
6	8.4 ¢ / kw-hr. + 24 ¢ meter rent per mo. double rate 10.8 ¢ / 4.8 ¢ per kw-hr. Ave. price 7-7½ ¢ / kw-hr. meter rent 36 ¢ per a.	9	6	22	0.13	0.29	Oct. 1st 1911	No Subsidy
7		7	10	30	0.21	0.46		
8		7	14	33	0.47	0.74		
9		9	19	45	0.42	0.72		
10	8.4 ¢ / kw-hr. + 10 ¢ meter rent per mo. flat rate 1-Lamp of 60 W $ 3.60 p.y. every successive lamp $ 2.40 p.y.	4	18	61	0.27	0.67	Apr. 1st 1912	$ 4.80 Subsidy for every new lighting installation since Jan. 1st 1913
11		7	17	74	0.31	0.70		
12		7	22	66	0.38	0.66		
13		4	47	97	0.71	0.96		
14		4	50	100	0.70	1.00		
15	10.8 ¢ / kw-hr. + 12 ¢ meter rent double rate *) 10.8 ¢ / 4.8 ¢ Ave price 7-7½ ¢ per kw-hr. meter rent 36 ¢ per mo. Flat rate 86 ¢ p. 10 Watts Min. 60, Max. 300 Watts	1		74		0.74	Apr. 1st 1912	$ 0.96 Subsidy for every lamp installed within 3 mo. after operation of local lines is begun
16		1		60		0.60		
17		1		68		0.74		
18		1		90		1.37		
19		1		76		0.65		

*) "Double Rate" is a rate system rather frequently used in Germany whereby a certain higher charge is made during peakload hours – in this case 10.8 ¢ / kw-hr – and a lower one – in this case 4.8 ¢ – for off peak hours. Meters which automatically switch over to on-and off-peak rates resp. every day are used. The development is not yet concluded

Dated Feb. 1st 1913

figures indicate the month, and thirty-one arabic figures on the right side allow the date of the month to be marked. Below this a space of about half an inch in height is set aside to write down the village, the street and the street numbers of the respective houses, below which space a table can be seen, the four horizontal divisions of which are set aside for the first, second, third and fourth floors. Every one of these horizontal divisions is then divided into vertical subdivisions to receive the names and data of the respective tenants on each floor as indicated in the translated reproduction of the card.

The code printed at the bottom of the card is used for filling in the last column. Of this code the cipher "3" (next visit to be made on date of ———) has to be followed by a date, and this same date is indicated by green riders as shown in the illustration. This is the object of the second row of figures from the top, which indicates dates as mentioned above. These riders, therefore, serve also to indicate at a glance which visits should be made every day. Red riders are used if there are prospective customers in the respective houses, and blue riders for such large customers as are of particular importance and on whom an eye should be kept. The vertical rows of letters on the left and right edges of the card are used to indicate the first and last letter of the name of the respective village.

The solicitor, when starting on his rounds, gives receipts for cards from the filing system for as many streets as he thinks he can work within a certain period of time and proceeds quite systematically from one house to the next. The cards are filled in only with pencil, so that the entries can be changed as necessary. The solicitors, as in almost all other cases, receive a fixed salary, and a commission for every lamp or horsepower secured, the commission being 18 cents per incandescent lamp and 24 cents per horse-power connected.

Werdau Advertising Methods

Personal visits of the solicitors to the prospective customers are recognized in Germany to be the most effective means of advertising. This does not mean, however, that invariably they are the only method of advertising. A vigorous advertising campaign is being

TABLE II—SYSTEMS EMPLOYED IN PAYING FOR WIRING INSTALLATIONS

	METHODS OF FINANCING SMALL CONSUMERS						
METHOD	Installation made at Electric Light Company's expense Sometimes called "Gratuitous Installations"				Installations made at consumer's expense Non repayable subsidies towards cost of Installation granted by Electric Light Company		
	Consumer acquires ownership by:-		Consumer does not acquire ownership and pays for capital invested by Electric Light Co. by:-				
	Having made installment repayments for a certain number of years	Having paid the minimum bill guaranteed under these contracts for the stipulated number of years	Paying a certain rent which in case of flat rate can be included into the latter	Using prepayment meters which charge a higher rate than the ordinary one	In cash as certain amount per lamp	As reduction of rates for a certain period of time	
						Gratuitous Energy One Year not exceeding amount of (previously approved) Cost of Installation	70% Discount First Year
NAME	Instalment "Installation" System		"Rental Installations"	"Gratuitous Installations with Prepayment Meter"	"Subsidiary Installations"	"Gratuitous Energy - One Year System"	
EXAMPLES	Strassburg Country, Strassburg City 2nd 3rd and 4th Lamp Dortmund, Munich For Fixtures Dortmund	Strassburg City 1st Lamp	Milan (rent included in flat rate,) Werdau (both with flat rate and meter rate) For Fixtures Munich	Dortmund Elsterberg	Trier Borås	Gothenbury Borås	Drammen
	The large soliciting power of the flat rate alone without any methods of financing or advertising is illustrated by the example of Oberschlesische Elektrizitätswerke						

carried on in newspapers and by pamphlets. Groups of consumers are invited to inspect the central station. Speeches are delivered at these times, for instance, to the effect that the factory chimneys must disappear, everything must become electrical, etc., and the daily press prints these speeches. At other times all the farmers of the surrounding country receive invitations, care being taken that they get acquainted with everybody in the administration of the central station. At Christmas consumers and prospective consumers receive little presents, with the compliments of the central station; for instance, one year the latter sent out honey cakes with a colored sugar crust showing a picture of a tungsten incandescent lamp as good as it could be made with that crude material (Fig. 6). This cake was inclosed in a box, both sides of which are also shown in this illustration. The bottom side shows a picture of an incandescent lamp, whereas on the top are printed doggerel rhymes about the many different uses to which electricity can be put, each line beginning with the word "electric." Another year a thermometer on a base in the shape of an incandescent lamp (Fig. 8) was given, packed in a cardboard box. Both sides of the box are also shown in the illustration, one side having a picture of a number of energy-consuming devices under a Christmas tree, the other side being marked with the ordinary signs which are used with shipping cases with fragile contents, except that, besides the rough drawing of the glass which is ordinarily used in such cases, the outline of an incandescent lamp also appears.

The result of all these methods of soliciting and advertising, of financing and charging, is that at present, in the country communities around Werdau which belong to the supplied territory, about 90 per cent of all possible customers are already connected, and in the city of Werdau 30 per cent are connected. To appreciate this latter figure, it should be remembered that, as stated before, Werdau has only about 25,000 inhabitants. The percentage of consumers in small towns is not so great as in larger cities, and moreover in the little town of Werdau electricity has to compete with gas. It should be noted also that the gas company has followed the example of the electric company and imitated its financing methods. The gas company does even more than the electric-light company and promises the customer to install his gas mains gratuitously if he will contract to use no electricity on his premises within five years.

Instalment Installations at Dortmund

Among the many central-station companies where systematic and successful efforts are made for increasing the load by the acquisition of small consumers, the central station of Dortmund, in the Westphalian industrial district, is one of the most prominent and interesting. As can be seen from Table III the company provides both instalment-plan installations and rental installations.

The installations on the instalment plan are made for from one to twelve sockets. The consumer pays 58 cents a year per lamp and an additional sum of $2.30 for the panelboard; or, if more than one panelboard should be used in the house (as, for instance, in tenement houses), this latter charge is reduced to $1.15 per board. These charges are payable in monthly instalments for four years and include the refunding of the cost of wiring, so that, after that time, the installation becomes the property of the consumer. As the table also shows, this period of four years is rather short as compared to the time allowed in some other cities, which is as long as ten years. These consumers are served under the regular meter rate at from 7 cents to 9½ cents maximum per kw-hr. (the rates vary slightly in different villages).

Rental Installation with Prepayment Meter Rate

Very small consumers with from only one to three lamps connected can choose a prepayment meter rate with the installation also made at the expense of the electric-light company. In such a case the customer does not have to refund the cost of installation; the latter accordingly remains the property of the electric-light company for an indefinite time. These prepayment meter consumers buy energy at a slightly higher rate than the ordinary meter-rate customer, namely, at 12 cents per kw-hr., and have to bind themselves not to use any other illuminant. As is evident, such a rate is especially adapted for the poorest people, since only very small amounts are payable at one time.

The third optional rate for very small consumers is a flat rate with a limiting device, at 24 cents per month for 30 watts, 30 cents for 40 watts, 48 cents for 60 watts, and so on, 24 cents being charged for every 30 watts up to $2.88 for 360 watts, which is the maximum.

The number of installations made at the expense of the central station was most gratifying in Dortmund, with its large laboring population. In two months 1000 sockets were installed at the expense of the electric-light company for gratuitous prepayment meter installations of from two to three lamps each. Lamps and fixtures are not included, but the consumer may rent the fixtures from the electric-light company.

Rental of Fixtures

About four years ago the municipal plant at Dortmund discovered that there were quite a number of residences in the city which, although wired, were not connected to its lines. The bill collectors were commissioned to find out why the houses were not connected. In Dortmund itself, a city containing about 150,000 inhabitants, 700 wired houses in laborers' quarters were not receiving service. The reason given ordinarily was that electricity was "too expensive," but on delving more deeply into the matter it was found that the real reason was that the tenants had come from flats where they had been using only gas or oil and were not willing to incur the expense of installing electric fixtures. As a result of these investigations, the lighting company resolved to rent electric fixtures as the local gas company had already been doing with gas fixtures. At present thirteen different types of fixtures are being rented at prices ranging from 4 cents monthly for simple ceiling fixtures with enamel reflectors to 72 cents per month for elaborate chandeliers for four lamps. The price for putting the fixtures in place is 48 cents. After the rent has been paid for three successive years, the tenant acquires ownership, so that the payments which are designated by the company as rent are actually instalment payments. In order not to cause dissatisfaction among the contractors, and to avoid criticism by them, the rents are fixed high enough so that a three years' rent amounts to the list price of the fixture, the list prices being, moreover, so high that discounts of from 60 per cent to 70 per cent are ordinarily given.

On Jan. 1, 1913, about three and one-half years after the system had been introduced, rental contracts for 11,300 fixtures had been made, of which 5500 were contracted for in the last year alone. It was possible to fulfil these 11,300 contracts with a supply of only 10,500 fixtures, since a certain number had been returned to the company before the expiration of the three years in cases where the tenants moved out of town, and these returned fixtures were polished up (and, if necessary, repaired) and rented out a second time. The customer when moving before the expira-

tion of the three years has the option either to return the fixtures or to pay the balance in cash. Ordinarily the customers choose the latter alternative, in case they have paid the rent for more than one and one-half years; otherwise they usually return the fixtures.

The total capital invested for these 10,500 fixtures is $17,800. The revenue from renting fixtures during these three and one-half years was $12,600. The capital outlay during the greater part of these three and one-half years was, however, considerably lower than $17,800. Since the instalment payments for the fixtures extend over a period of three years, the company may expect an additional $26,400 from that capital of $17,800 within the three succeeding years, 1913-15. Aside from this, there was the increase in energy sales, which after all was the real object.

It should be stated that the fixtures are furnished complete, including tungsten lamps and the labor for connection. The cost of the lamps and labor is not included in the above figures, but it does not materially change the results. The experiences in Dortmund show clearly that it is not only the cost of wiring but also

FIG. 21—TRIER COTTAGES WIRED FOR ELECTRICITY

the cost of fixtures which deters the small customers from getting their light from the central station.

Energy Consumption of Flat-Rate Customers

Director Döpke of the Dortmund central station has made some interesting experiments with demand limiters. For purposes of comparison, in 500 houses watt-hour meters were installed in addition to the demand limiters, with the following results: The amount paid under the flat demand rate, reduced to the average price per kilowatt-hour actually consumed, was between the limits of 3¼ cents and 10 cents and in one case reached 20 cents per kw-hr. In this latter case, however, the consumer was notified that he was not using the electric light to its full advantage, as the electric-light company is of the opinion that where the flat rate is used the people should get the full benefit of it. The total average price per kilowatt-hour for all flat-rate consumers was 6¼ cents. The annual use of the maximum demand flat-rate consumers varied between 3007 and 840 hours a year.

Advertising and Soliciting

Outside of these schemes of wiring houses at the central stations' expense and of renting installations and fixtures, the company also carries on an active advertising and soliciting campaign. Personal canvassing is considered the most effective means of advertising. It has been found important in soliciting the small man's business, especially in the country, that the prospective customer find in the solicitor a man of about his own education and possessing his own ways of thinking and talking. Consequently the solicitors are mostly chosen from the staff of wiremen, such men being selected as have shown a certain gift of speech and ability for handling men. These wiremen go out with their uniform caps and talk in Low German dialect to the customers, thereby obtaining a better hearing from the latter.

Nor is the more impersonal method of advertising by printed matter neglected. The central-station company, for instance, issues a monthly periodical describing the various uses of electricity, notes about the progress of the central station, etc., and everything is of course profusely illustrated. Theater programs have printed on the border: "Electric Light—Everybody's Light! Cheap! Cheap! Cheap!"

Canvassing Rural Population at Neuss

Another interesting case of canvassing among the rural population is afforded by the municipal central station of the city of Neuss. According to Mr. Frank, of Neuss, lectures are given in winter in the village inns, and expositions are held to which the people are invited at the close of the church service. Every village is revisited about every second year. The lectures, of course, give information about the cost of electric light. During the lecture the audience is informed that repairs will have to be made on the electric lines near the respective villages, and that all applicants for electric light during that time will be connected to the lines without charge for service connections. Wiremen take seats among the audience at the tables and are paid a commission for every application they get. After the lecture applications and discussion are invited.

Electric Service at Munich

Among the many interesting places where similar efforts are made to extend the use of electricity is the city of Munich. In 1911, simultaneously with the electric exhibition in Munich, the electrical rates in that city were lowered from 14½ cents to 12 cents per kw-hr., and a few optional rates were introduced in addition to the straight meter rate. Three other innovations were made to push the use of electricity, as follows: (1) An information office was established in which an employee of the central station gave all required information by word of mouth. This office is maintained in connection with a permanent exhibition of heating and cooking appliances. (2) Wiring for staircase lighting in apartment houses, as well as the mains for lighting the rest of the building, is installed at the expense of the city; repayment of the cost to be made in eight yearly instalments. In Munich and in a number of other German cities staircase lighting is done on a flat rate in connection with an automatic time switch. (3) Every apartment-house owner who installs the mains with branches to every flat and guarantees to light his staircase electrically with at

least three lamps for five years is connected to the street circuits free of charge.

The effect is shown by the following figures: In 1911 547 house connections were made and 2077 meters installed, and in 1912 1225 house connections were made and 5286 meters installed.

Furthermore, light fixtures, flatirons, etc., are rented at prices covering only the expenses, as, for instance, a desk lamp at 5 cents a month and a four-lamp chandelier at from 15 cents to 20 cents a month. These fixtures, however, do not become the property of the consumers after a certain period of time, as in Dortmund, but remain the property of the city. Printed on the backs of bills are illustrations of fixtures which are for rent.

As regards the effect of articles on the uses of electricity, which are printed every now and then in the daily papers, Director Zelle of the municipal central station in Munich pointed out that the inquiry office, established for the use of consumers and prospective consumers, ordinarily gets from fifty to sixty inquiries a day, but on the days following the appearance of an article in the papers from 180 to 200 inquiries are received.

Trier

Also in the city of Trier the central station gets good results from its methods of pushing the use of electricity among small consumers. These methods have to be confined, however, to rural communities, since in the city itself the (municipal) central station is not permitted to make any advances or payments on wiring installations because the gas works also belong to the city.

Rural customers, however, receive a subsidy of $4.80 from the central station for the first two lamps installed, which subsidy is not repayable and is granted only if the customer connects within a certain number of months after his respective village has been connected to the lines of the central station. The result has been that no village has yet been connected with less than 50 per cent of the possible consumers on the lines. The contractor who does the wiring receives the $4.80 directly from the central station and has to subtract that amount from the bill rendered to the consumer. Moreover, no charge is made for service connection and no fees are levied for examining and testing the installation.

Flat Rates at Trier

The following experiences and views are taken from lectures and other statements by Director Henney of the Trier central station:

Flat rates, about 87 cents per 10 watts a year, are extensively applied by the city of Trier. The inhabitants of the agricultural communities around Trier for the most part have very limited incomes and would not countenance the watt-hour meter. The management of the central station concluded that the watt-hour meter is and always will be an odious instrument for small consumers, and one in which they will have no confidence. This method of charging is foreign to most of them. The impossibility of knowing the annual expense in advance, and the irregularities which occur make the meter an instrument of control, in their eyes, which has to be viewed with the greatest distrust. This distrust cannot be banished, either by lectures or by experience. In addition to this, the meter rent is regarded as unjustifiable. Farmers, small tradespeople and laborers can therefore generally not be induced to use electric light under the meter rate. Moreover, in those few households which are connected under the meter rate, the yearly income of the central station for lighting, due to excessive economy on the part of the consumer, often does not exceed $2.50 per family. These revenues will still decrease in the years to come, in consequence of the brilliant progress which the art of lamp manufacture has made in the past few years. In many plants they will not cover actual expenses.

The flat rate with current limiter is an excellent method to push the business, to secure a sufficient revenue from the customers, to reduce the fixed expense per customer, and to reduce the capital invested.

Table I shows the results of the flat rate in nineteen communities around the city of Trier, proving the first two points of the above statement, as far as that particular central station is concerned.

Flat Rate a Feeder for the Metering System

It might be stated here that in a number of cities—for instance, in Eschwege—experience has shown that

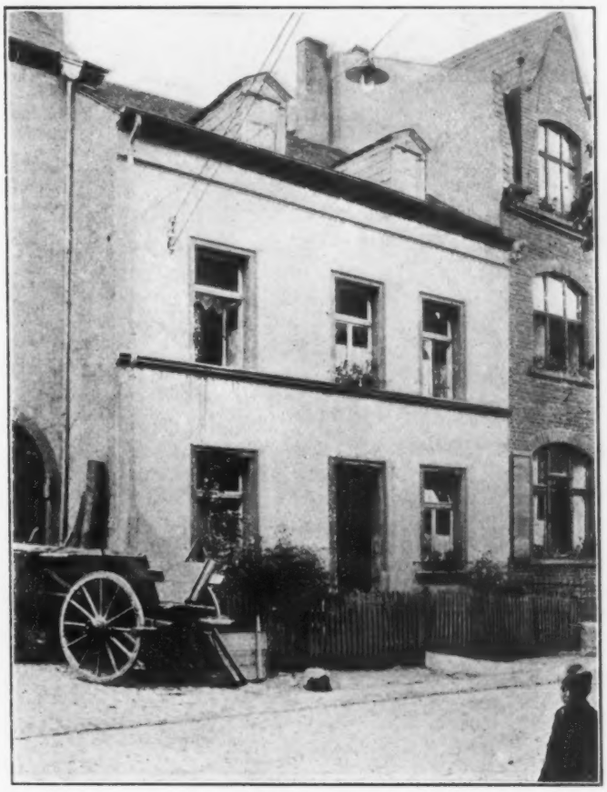


FIG. 22—SERVICE TO TRIER COTTAGE

frequently customers who were connected up under a flat rate after some time shifted over to the optional meter rate. Although, therefore, the relation between the numerical values of the flat rate and the meter rate in these cases apparently is such that these consumers pay less on the meter basis, still the flat rate was more successful in getting them on the lines. These customers could not be connected at the meter rate; in other words, the flat rate is a good business getter.

As regards the third point, the reduction of fixed expense per consumer, the Trier flat-rate charge of about 87 cents per 10 watts is collected in three equal instalments on Oct. 1, Jan. 1 and April 1, thus leaving six months to cover for the summer instalment and three months only for each of the winter instalments. This, of course, simplifies accounting and collecting very much. In the bookkeeping department every consumer gets a leaf in a loose-leaf accounting book (Fig. 14) and a card in a card file. On the head of the leaf below the name, address and number of the customer are entered the number of watts for which he has con-

tracted and the corresponding yearly amount. Below these are printed forms of the following shape, for a number of successive years:

Year
19..
April/September .....marks....
October/December .....marks....
January/March .....marks....

These three lines are sufficient for the whole year, and since in every line the same amount has to be inserted, unless the consumer's contracted load is altered, it is evident how very much simplified bookkeeping becomes with this rate system. As regards billing and collecting, the bill is simplified in a similar degree and is remarkable for a little scheme of charging the cus-

FIG. 23—COTTAGES IN TRIER WIRED FOR ELECTICITY

tomer for delays in payment which necessitate a second and third visit of the collector. Fig. 10 is a photograph of the bill showing on the left-hand side three detachable coupons, the top one reading:

COLLECTING OFFICE: BAHNHOFSPLATZ 11.
Open 9-12, 3-5. Closed on Sundays and Holidays.
POST-CHECK ACCOUNT NO. 8800. POST-CHECK OFFICE, COLOGNE.
I.
MUNICIPAL CENTRAL STATION TRIER.
The flat-rate payment agreed upon amounts to M.....
First visit of collector.

The second coupon (leaving out the head of the coupon, which is the same as above) reads:

The flat-rate payment agreed upon amounts to	M.....
Second visit of collector.....	0.10
Total	M.....

Similarly the third visit shows also an increase of 0.10 mark, or 2.4 cents, for the collector's visit. In case the customer pays the collector at once on receiving the first visit, the whole bill, with all three coupons, is left with him, and the second and third coupons are of no further use. Otherwise he keeps only the top coupon, and the rest are taken by the collector.

Flat-Rate Collecting Cards

Other instances of collecting cards in other places with a flat rate are given in Figs. 11, 12 and 13, one of the Oberschlesische Elektricitätswerke, where the amount is collected quarterly, and the other one in Potsdam, near Berlin, where the bill is to be paid either quarterly or monthly. A receipt form is made out for the whole year and the amount is collected every month in advance. This receipt form on cardboard is divided by perforations into twelve coupons, and one of them is simply torn off every month when the payment is made and handed over to the customer as a receipt by the collector. In this way clerical work is very much reduced.

Even this simple procedure is still further simplified by a number of central stations for certain consumers, especially if the periodical payments are to be made weekly, which, of course, is desirable for the poorer class of people, such as laborers, etc. Sometimes, for instance, the proprietor of a beer garden does the collecting for the central station, either for a small fee, or he may be satisfied by drawing the people into his locality in that way, on the same principle as the drug-stores in this country are selling postage stamps without any direct profit, simply relying on the increased opportunity for sales which they get thereby.

In other cases the municipalities of villages and small towns will do the collecting for the central station for a nominal compensation. Also the post is used for collecting by means of the so-called "post-check system," which might be described as a simplified and cheapened money order, whereby the sender does not have to go to the post office but can use any letter box.

In industrial districts, where weekly payments are made on the flat-rate basis by laborers, the bills are collected by factories by deducting the constant and known amount of these payments each week from the wages. The factories do not make any charge for attending to this collection, because they are glad to contribute in this way to the betterment of the social conditions of their laborers without any expense worth mentioning.

The expenses of the central station with 3000 meter consumers have been found to average in Trier about $1 a year for meter reading, accounting and collecting, an amount which seems low in comparison with that given by other central stations. Meter reading, of course, becomes entirely unnecessary with flat rates, and collecting is done in three annual instalments as described above, thereby reducing the collecting charges considerably in comparison with meter rates. According to the experiences made so far, 75 cents can be saved from these expenses per customer a year, which is a very substantial percentage of the average revenue from small lighting customers.

Losses from Extravagant Use of Energy Under Flat Rate Not to Be Feared

It is sometimes stated as a drawback to the flat rate that losses can be caused to the central station by the extravagant use of the energy on the part of the flat-rate consumer. In reply to this it ought to be considered that the above saving of 75 cents enables the central station to provide with energy the average small consumer of 70 watts at a cost of 0.75 cent per kw-hr. for about 1400 hours a year beyond the ordinary period of

time without incurring a loss. It might also be stated that the energy loss in the potential coil of a watt-hour meter ranges from 12 kw-hr. to 20 kw-hr. a year and more, according to the type of instrument used and the voltage. The meter system, therefore, in addition to the maintenance expenses of the meter, causes an extra expense which for small consumers is not at all negligible. By considering the losses in the potential coil the above figure of 1400 hours is raised by several hundred hours.

As regards the fourth point, the capital invested, it is self-evident that by using demand limiters, which cost only a fraction of the price of a meter, in place of a meter, the capital invested for small customers will be considerably reduced. It is also sometimes considered an injustice of the flat rate that "one consumer pays more per kilowatt-hour than another one."

The fundamental lines of reasoning in the following paragraph are taken from lectures, addresses, etc., by Director Agthe, of Gleiwitz, it being principally a quotation from his Berlin lecture on Feb. 17, 1913:

The cost of construction of the total equipment for furnishing electricity approximates roughly $400 per kw.[7] The diversity-factor for the general system appears to be somewhere between two and one-half and three and one-half. Considering, however, very small residences, for which the flat rate is chiefly recommended, it may be assumed that the diversity-factor is not more than perhaps two, since a larger percentage of the lamps will be burning during the whole evening than in average residences. Under these assumptions the capital per kilowatt of connected load will be roughly $200 and, allowing 12 per cent for interest and depreciation, the fixed expense will be about $24 a year per kw. The operating expenses consist of fixed and variable charges, the former amounting to approximately $12 per kw and the latter to about ¾ cent per kw-hr. or less. The yearly expenses per kilowatt are, therefore, in case of a very small load-factor, roughly from $37 to $40 and, in case of a load-factor of 1900 hours per year, roughly $50.

This small increase in the expense between no load and the large load-factor represented by 1900 hours shows that the flat-demand rate is comparatively just, even in cases of rather variable load-factors. If it is claimed as an objection against the flat rate that the customer who is wasting electricity gets his energy cheaper than his neighbor, it will be understood from the foregoing that the objection to a straight meter rate, where a customer with a small load-factor obtains his kilowatt demand cheaper than his neighbor, is a more severe one, because the kilowatt demand bears a more important part in building up the cost than the kilowatt-hour.

The results of the flat rate in Trier, combined with the wiring subsidies previously mentioned, are shown in Figs. 15, 16 and 17, which are photographs of some inside installations in the residences of very poor peasants around the city of Trier. Figs. 19 and 20 show a typical barn of a poor peasant lighted electrically, and Figs. 18, 21, 22 and 23 depict the outside of a number of cottages which clearly indicate that they belong to the poorest classes, whereas the insulators on the walls and the house connections prove that electric light is used within.

As regards the influence of a proper flat rate on the use of electric illumination among the poorer population another instance may be cited. Mr. R. G. Hochstein reports in the *Elektrotechnische Zeitschrift* of Feb. 20, 1913, page 215, that flat rates in Egypt have been introduced with such good effect that in many Arab quarters even the most ruinous, rickety, tumble-down shanties have their flat-rate lamp and oil is hardly used at all any more.

[7] According to Table 72 on page 70 of the Bureau of the Census, "Special Report, 1907, on Central Electric Light and Power Stations," the average cost of plant and equipment per kilowatt rating of the plants of the United States in 1907 was $405.

Flat Rate in Leipsic

In the city of Leipsic, in Saxony, flat rates have been in effect since 1900, on the connected load basis. Since 1910 the flat rate has been changed over to a demand-limit flat rate, with the following results:

1900:	688	flat-rate installations and	964	meter installations.
1905:	1,952	flat-rate installations and	5,131	meter installations.
1910:	7,989	flat-rate installations and	6,919	meter installations.
1911:	12,343	flat-rate installations and	5,717	meter installations.
1912:	16,293	flat-rate installations and	5,148	meter installations.

The printed statistics on this matter are rather confusing. The number of inhabitants of Leipsic is 600,000.

The 16,293 flat-rate installations brought a revenue of $188,000, or $66.50 per kw-yr. The total average revenue of the central station from all consumers is $48 per kw-yr.

Oberschlesische Elektricitätswerke

One more example of a flat rate with a limiting device is afforded by the Oberschlesische Elektricitätswerke in

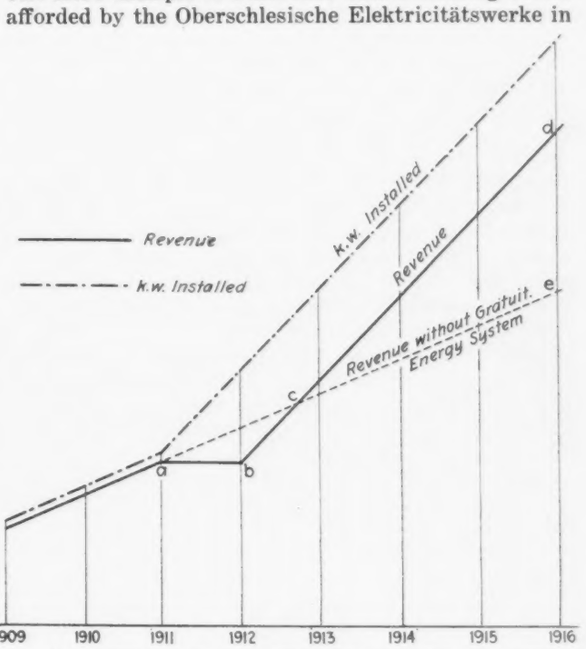


FIG. 24—EFFECT OF FREE-ENERGY SYSTEM OF WIRING ON REVENUE

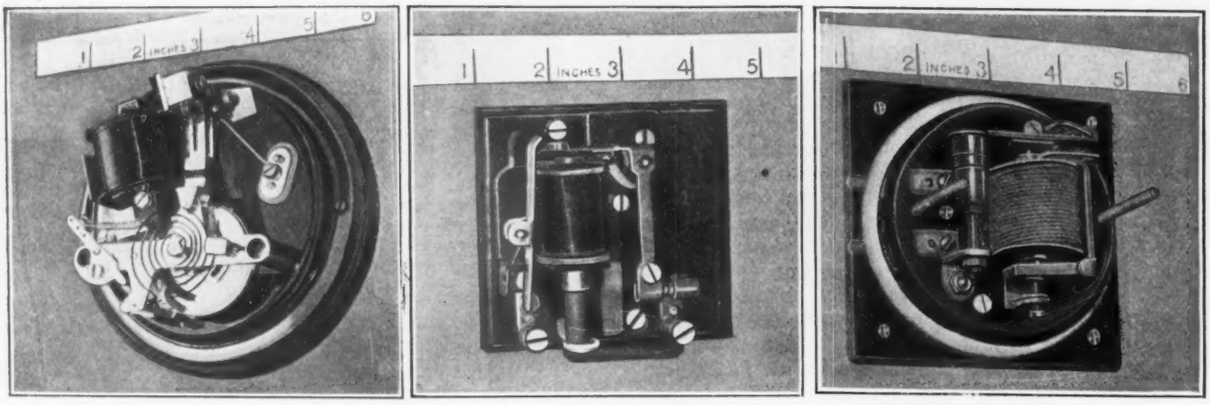
Prussian Silesia. This company is a pioneer in spreading the use of electricity among the small consumers merely by the use of a judicious rate system. This latter is a flat rate with limiting device for small loads of between 30 watts and 1000 watts. The price is $57.60 per kw per year plus a constant yearly amount of $1.44 for every installation, with the restriction that the average cost per kilowatt-year must not be more than $72. This means that small consumers up to 100 watts pay 72 cents for every 10 watts per year, and larger consumers, gradually decreasing with the size of the installation, from 72 cents to 59 cents per 10 watts per year.

The electric-light company outlines the advantages of the flat rate to the consumers as follows:

(1) The consumer knows in advance what amount he has to pay every year.

(2) Payments are made in equally distributed quarterly instalments.

(3) By the installation of a limiting device the consumer is protected from unintentional increases of load and from the resulting additional expense.



FIGS. 25, 26 AND 27—VARIOUS TYPES OF INEXPENSIVE MAXIMUM-DEMAND INDICATORS

(4) The annual expenses for small and medium-sized installations are, as a rule, lower with the flat rate than with the meter rate.

The latter point, of course, as well as the success of the flat rate as a whole, when compared to the meter rate, depends largely on the relative value of the figures (cents per kilowatt-year and cents per kilowatt-hour) employed in the rate schedule.

Flat Rate in Competition with Oil and Candles

The electric-light company further points out that with this flat rate electricity can be used in any household if $2.15 a year, or 18 cents a month, can be allowed for lighting (30 watts). Where kerosene oil is used experience shows that even very small families use more than 2 gal. of oil, at a cost of about 35 cents per month. This example quoted by the electric-light company of a family using a maximum simultaneous demand of 30 watts only to cover their total demand for lighting shows what very small consumers the electric-light company has on its lines and is soliciting.

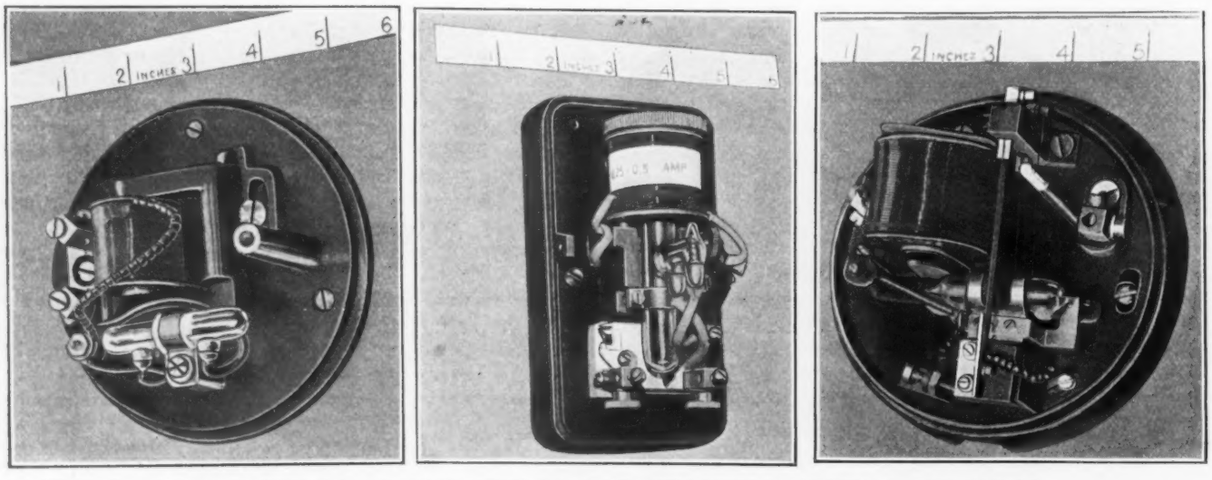
Another rate of the Oberschlesische Elektricitätswerke optional with the flat rate is the Wright demand rate, at 9.6 cents per kw-hr., up to 500 hours' yearly use, and 1 cent per kw-hr. for the rest. The flat rate, however, is so popular that on July 31, 1913, over 18,000 consumers were using the flat rate and only 2500 consumers were connected on the Wright demand rate.

Data on Flat-Rate Consumers

The relative size and number of flat-rate consumers on March 1, 1911, are given in a table which was published in the *Elektrotechnische Zeitschrift* on Nov. 30, 1911. The 9818 flat-rate consumers who were on the lines on that date were subdivided into the following groups:

772	with loads from	30 to	50 watts.
2852	with loads over	50 to	100 watts.
2345	with loads over	100 to	150 watts.
1333	with loads over	150 to	200 watts.
727	with loads over	200 to	250 watts.
840	with loads over	250 to	375 watts.
479	with loads over	375 to	500 watts.
267	with loads over	500 to	750 watts.
112	with loads over	750 to	1000 watts.
70	with loads over	1000 to	1500 watts.
21	with loads over	1500 to	2500 watts.

On July 31, 1913, there were 18,051 flat-rate consumers connected out of a total of 23,000 consumers. This, taken in connection with the above figures of 9800 flat-rate consumers on March, 1911, shows that within two and one-half years the number of flat-rate consumers has increased by more than 8200, or 84 per cent. The territory of supply extends over thirty-nine towns and villages, with 650,000 inhabitants. It is claimed that even the most prominent large cities of Germany rank far behind Upper Silesia, the territory of supply of the Oberschlesische Elektricitätswerke, with regard to the consumption of energy for private lighting per capita. These results are all the more remarkable since the company has no solicitors at all and does not do much advertising. According to German statistics of 1913, about 10 per cent of all the customers were on the flat rate on that date.



FIGS. 28, 29 AND 30—VARIOUS TYPES OF INEXPENSIVE MAXIMUM-DEMAND INDICATORS

Gothenburg

Another method of popularizing the use of electricity was first introduced by Mr. Wikander, at present in Berlin. Mr. Wikander had been building the municipal electric central station in Gothenburg in Sweden some six years ago, and a yearly income of $80,000 to $110,000 had been estimated, when, just at that time, the metal-filament lamp made its appearance, and it was then believed that the revenues of the central station would be seriously impaired and fall below the required amount. At that time there were only 100,000 lamps installed, whereas the capacity of the newly erected central station and its feeders was sufficient for double the amount. Energy for another 100,000 lamps would therefore not have cost much more than the extra fuel used. Current limiters were not a commercial possibility at that time, and the scheme of free installations or wiring subsidies was not feasible, since nearly $2,000,000 had already been spent and it would have been impossible to obtain more capital from the municipality for that purpose.

Gratuitous Energy Scheme

Another inducement to secure new customers had to be found, and Mr. Wikander announced that every consumer who would wire his house at his own expense would have the expense refunded in gratuitous energy (computed at 9 cents per kw-hr.) during the first year, provided the consumers guaranteed the consumption of a certain number of kilowatt-hours for the year following. This plan has been in effect since October, 1909, and the result is that the central station has furnished a large number of kilowatt-hours "gratuitously."

The central station rapidly reached the limit of its capacity. The original number of 4800 customers had risen to 12,000 in 1912 and 20,000 in April, 1914 (total population 165,000), and the city expects to have all residences as customers within a few years.

To any one who has an electric installation made at his own expense the central station furnishes free energy for a period of time until the price which this amount of energy would have cost under the regular rates reaches the cost of installation, provided that this period does not exceed one year, and under the following conditions:

(1) That electric installations in the respective localities have not been connected to the central station previously (so that consumers cannot replace old installations by new ones at the expense of the central station).

(2) That the new installation necessitates separate meter readings (so that no unprofitable extensions in attics, cellars, etc., can be made at the expense of the central station).

(3) That the cost of installations for which gratuitous energy is furnished be not more than $4 per lighting fixture, or $13.50 per motor (so that only simple installations are paid for in this way).

(4) That a revenue for the following year is guaranteed to the central station from the respective installations of at least $1.35 per lighting fixture and at least $5.40 per motor.

The above applies only to residences, staircases, small shops and workshops in special cases, according to the judgment of the central station (so that gratuitous energy shall not be furnished for many new buildings in which other lighting methods are out of question).

The house owner has to agree to keep the installation in good repair for at least five years and to keep it at the disposal of the tenants gratuitously.

The installations are made exclusively by private contractors, and after approval of the estimate by the central station the consumers ordinarily agree with the contractor for a payment on account to be made at once and instalment payments for the balance. The most convenient payment method for the consumer is, of course, by monthly instalments, so that he has the impression of paying a bill for energy used. Since the cost of the installation is higher than the cost of energy during one year, the customer gets the habit of using electricity freely, which in its turn benefits the central station in the following year.

To illustrate the effect of this system on the development of the central station Mr. Wikander, whose own words have been followed closely in the preceding, has prepared a diagram (Fig. 24) which assumes that this system has been introduced at the beginning of the year 1912. Before that time the kilowatts installed and the revenue have been increasing proportionately to each other. On the introduction of this system the revenues remain constant for a year, because almost all newly installed lamps are using energy gratuitously. The kilowatts installed, however, have increased very much more than in the preceding years.

In the second year, 1913, the revenues, too, are increasing more rapidly than previously.

The additional cost to the central station for energy furnished is only about ¾ cent per kw-hr., so that every lamp installed under this system costs the central station (the rates being 9 cents per kw-hr.) not more than 33 cents if the cost of installation reaches the upper limit of $4.

Showing of the System

The method has been applied in Gothenburg since 1909 and has had the following results: During 1910 alone the number of consumers increased by 31 per cent from 5980 to 7785, although the building activity was very small.

The numbers of customers connected under the free-energy system during the first three years, in the order of the size of installation, were as shown in the accompanying table.

Presumably most of the 2864 consumers with fewer than five lamps could be induced to connect only on the "free-energy system." The expenditure for "free energy" was nominally $77,000—computed at the rate of 9 cents per kw-hr., although the actual additional expense to the central station was in the neighborhood of ¾ cent per kw-hr. Therefore the energy furnished actually represents $6,400, or $2,100 a year, or less than one-half of 1 per cent of the company's total revenue of $500,000.

CUSTOMERS CONNECTED UNDER FREE-ENERGY SYSTEM AT GOTHENBURG

Size of Installation	During First Three Years	Percentage
1 lamp	353	5.7
2 lamps	1168	18.9
3 lamps	689	11.1
4 lamps	654	10.5
5 lamps	532	8.6
6 lamps	481	7.8
7 lamps	440	7.1
8 lamps	352	5.7
9 lamps	288	4.6
10 lamps	222	3.6
11 lamps and more	1015	16.4
Total	6194	100.0

The gross returns in 1910 were $230,000, with a capital invested of $1,960,000, or 11.7 per cent, and in 1912 they rose to 18.2 per cent ($324,000 from an invested capital of $1,780,000), although the trans-

mission and distribution system is only two-thirds loaded.

Flat Rate in Gothenburg

Gothenburg has also a flat-rate system. About 2500 of the 13,000 consumers of a year or two ago were served on the flat rate (inhabitants 165,000). This rate ($1.90 a year per 20 watts, as per schedule) is also combined with the gratuitous energy system. The consumer gets as many watts free as he wants (the equivalent in yearly rent, however, not to exceed the cost of the installation), and the consumer has to contract to pay for the same number of watts the following year. This flat rate has been reduced recently from $1.90 to $1.62 per every 20 watts if the owner of a laborer's tenement house installs one lamp in every room of the latter. Only one current limiter is provided for every building, and the house owner does the collecting by making a corresponding addition to the rent. In return he gets one staircase lamp free of charge for every ten lamps installed.

The "gratuitous energy" system is mostly applied in the Scandinavian countries, where it originated.

Drammen

A similar system has been in use in Drammen, Norway, since Jan. 1, 1911. Small consumers occupying three rooms and kitchen get a discount of 70 per cent from the price of energy for the first year, instead of free energy as in Gothenburg. A flat rate prevails, either 4.9 cents a year per hefner candle installed, corresponding to a little over $5 per 100 watts installed a year, or, with current limiters, the consumers pay $3.93 per 100 watts maximum demand a year.

Boras

A system of this kind is also in use in Boras, in Sweden, where the customer has the option of gratuitous energy for a year under conditions similar to those of the Gothenburg system, or, if he prefers, a subsidy in cash of $2.15 per lamp outlet. In the latter case he must guarantee the central station a minimum income of $1.62 per lamp outlet a year for the first two years.

In the thirty-two months during which this system had been in force at the time of investigation the number of customers had increased from 600 to 1750, and, according to the management of the central station, of these additional 1150 customers at least 600 consumers were due to this system alone and would otherwise never have been connected.

Delft Real-Estate Agency as Solicitors

An interesting method of pushing the use of electricity was found in Delft, Holland, where the central station pays to real-estate agencies $2 for each kilowatt connected for which application is made during the time when the building is for rent or sale. This commission applies only for houses which are not yet connected; in buildings which are already connected to the lines it is reduced to 80 cents per kw installed. The result is that the rental agency has an increased interest in recommending to the house owner the wiring and connection of the respective buildings and in pointing out the increased possibilities for sale or rent.

Prepayment Meter as Solicitor at Elsterberg

An interesting opinion was given by the manager of one of the central stations about the prepayment meter. In this place (Elsterberg) gratuitous installations are made by the electric-light company with prepayment meters, and the consumer has to contract to use $4.80 every year with these prepayment meters. The interesting information was imparted that every prepayment installation of that kind results in the connection of two or three other consumers who pay for their installation themselves.

Ordinarily the small consumers who contract for prepayment meter installations do not figure their expenses very closely. As a consequence, they are not so well off as friends and acquaintances with a like income. Electricity, of course, pleases these friends very much and is also praised by the prepayment customers. The desire to have such safe, clean and beautiful light will assert itself the more since these friends and acquaintances can afford this kind of light even better than the original prepayment meter customer. Envy also plays its part. Inquiries are made at the electric-light office and the information is imparted that the use of prepayment meters is really more expensive than that of ordinary meters (17 cents as against 12 cents per kw-hr.). Many then decide to pay for the installation themselves.

It is impossible to quote in detail every instance found where successful methods for increasing the business by attracting the small consumers are employed. These instances are too numerous, and a reference to Table III, although necessarily incomplete, must suffice.

Table II is an attempt at a classified summary of the methods of financing small consumers. This table shows that there are two large subdivisions, (1) installations made at the expense of the electric-light company and (2) those made at the consumer's expense. In the first case either the consumer by his payments automatically acquires ownership after a certain number of years or the installation remains the property of the electric-light company indefinitely. Where the installation is made at the consumer's expense, the electric-light company may give a subsidy which may consist of a cash payment or energy free of charge.

In the lower part of the table are noted various instances described more fully in the text. Of course there are a large number of other citations besides those mentioned, but they are more or less all covered by the same classification.

It is also possible that different features of the different systems may be combined in a new system. Thus, for instance, a consumer might get an installation at the electric-light company's expense provided he contracts for a certain minimum bill for a certain number of years (as in the city of Strassburg), but instead of becoming the owner of the installation after that time the installation might remain in the ownership of the central station, as, for instance, in Werdau. This and other combinations, however, have not been found in practice.

The writer is convinced beyond doubt: (1) That the small customer has become an important source of revenue to many of the central stations in Europe; (2) that the possibilities of this source of income and the degree to which it is being appreciated by the European central stations are growing constantly as the efficiency of the methods of transforming electricity into light is improving. It may also be predicted that in the near future the small customer will become recognized as of greater value to the central station than heretofore. It is to be observed that to bring this about will involve radical changes in the present methods of billing, metering, meter reading, inspection, methods of introducing services, lamp-renewal policies, rates for energy, etc.

Much of the work done in connection with the small consumer depends on a cheap form of demand indicator. There are many such on the European market, costing in the neighborhood of a dollar. Various forms of these indicators are shown in Figs. 25 to 30, on page 1172.

Inexpensive Wiring Methods Followed in Europe

The methods of wiring vary even within the same country.

Flexible twin cord on glass buttons, one of the oldest wiring schemes, is still used when the installation must be very cheap or where extensions are made to existing installations in finished buildings; but there is a marked tendency in most places to break away from this system in favor of more substantial construction. A number of central stations in Germany and Austria—for instance, in the whole northern part of Bohemia—are already prohibiting the use of flexible cord and glass buttons entirely.

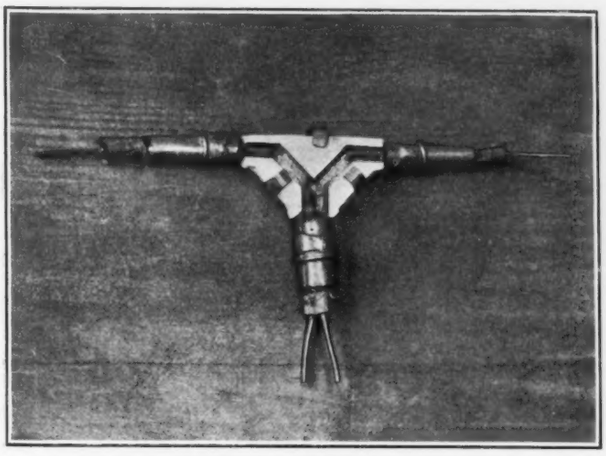


FIG. 31—T-CONNECTION BOX FOR KUHLO WIRE

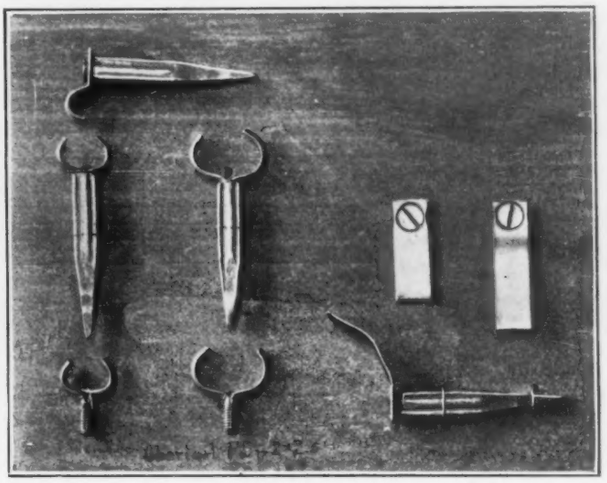


FIG. 32—DEVICES FOR FASTENING KUHLO WIRE TO WALLS

The next system to obtain favor was wiring in tubes made of paper impregnated with an asphaltum-like substance (Bergmann tubes). In later years these were protected by a thin cover (0.01 in. thick) of iron or sheet brass. These tubes were laid on or under the wall and rubber-insulated wires were drawn into them. Under the German rules the use of unprotected Bergmann tubes is now prohibited. These tubes must now be covered with brass or iron. The metal cover, however, is very thin and does not offer much protection against nails. One of the largest electrical firms in Germany, the Siemens - Schuckertwerke, introduced about thirteen years ago a system of enamel-covered steel pipes with open seams to permit condensation to escape. These tubes, which are called, after the inventor, Peschel tubes, are very thin, being about 0.03 in. thick. The weight of 100 ft. of tubes of 14-mm (9/16-in.) inside diameter is less than 19 lb. This pipe is also used on or under the wall, as the case may be. The separate pieces of tube, which are made in lengths of 10 ft., are joined to each other and to the fittings by means of couplings and held together, not by screw threads, for which the walls of the pipe would be too thin, but by the spring action of the open-seam steel pipe. The outside of the pipe is just a trifle larger than the inside of the couplings, and when inserting it into the latter the pipe must be slightly squeezed together.

In many instances this Peschel tube is used as a return circuit in cases where one of the conductors is grounded. In such a case, before joining the tubes and couplings together, the enamel of the former is scraped off as far as the coupling extends, and experience has shown that the electrical resistance of the system of steel pipes put together in that way is far below the permissible maximum. The cross-section of the tubes is dimensioned with a view to giving the tube the proper current-carrying capacity.

FIG. 33—DRAWING-ROOM INSTALLATION MADE WITH KUHLO WIRE

In Austria an inexpensive system of wiring is employed largely in stone and brick buildings, called "plaster hose." A groove 1½ in. deep is chiseled into the plaster and the brick wall, and a piece of very thick-walled rubber hose, greased with soft soap on

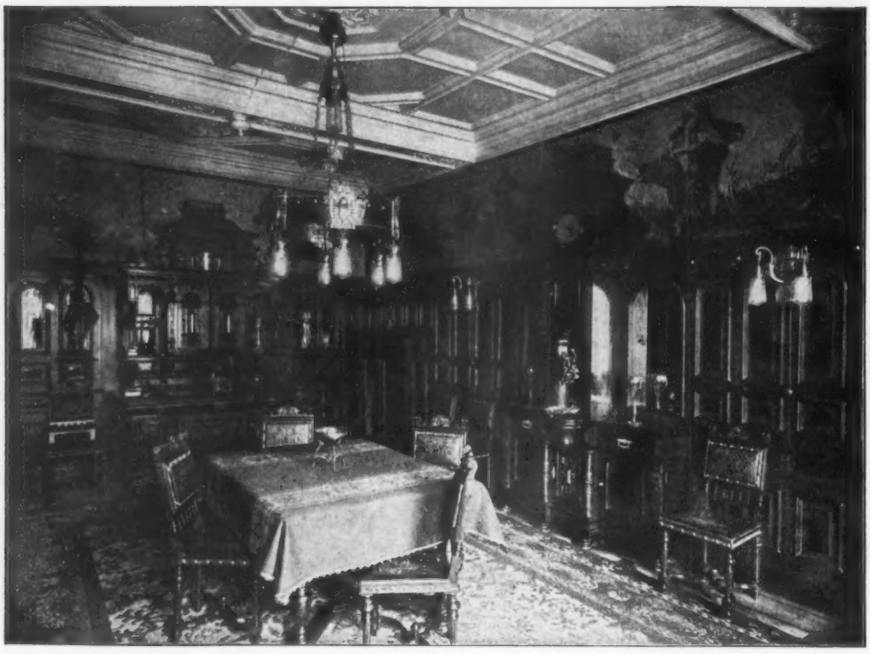


FIG. 34—DINING-ROOM INSTALLATION MADE WITH KUHLO WIRE

the outside, is laid in the groove. The whole is then plastered up again and finished off smooth on the outside. Both ends of the rubber hose, however, stick out of the plaster, and after the latter has hardened the rubber hose is pulled out, the soap preventing the plaster from sticking to the hose. The result is a hole running under the surface of the wall through which the rubber-covered wires are fished. If junction boxes are required a piece of wood in the shape of a truncated cone is inserted into the plaster, and after the plaster has hardened is removed in the same way as the hose. The round hole in the wall is afterward covered by a piece of circular sheet iron kept in place by two elastic metal strips riveted to the back of the sheet. The strips press against the side of the hole in the wall and keep the cover in place by friction. This cover may afterward be painted over or covered with wall paper, so that the whole installation when finished is practically invisible. This system, however, is now being more and more superseded by the Peschel system, since the latter is only slightly more expensive and much more substantial.

Recently a system of wiring which is rapidly taking its place beside the different inexpensive wiring methods named and is superseding them, especially in the wiring of existing buildings and in extensions of older installations where the installation must be made with as little disturbance and dirt as possible, has made its appearance. In this system two-conductor or three-conductor cable protected by thin brass or by thin lead-covered iron sheet is used. The thickness of this sheet covering is about 1/100 in. The metal is pressed around the insulated wire or cable and the edges are folded over one another in such a way that a seam results running lengthwise of the wire. This seam, which is tightly pressed together, is water-tight for all practical purposes, and, on the other hand, the metal cover which takes the place of metal tubes in other systems of wiring is in close contact with the insulation, without leaving a pocket for condensed water (Fig. 38).

In cases of grounded return circuits the metal covering may be used as the return circuit, the carrying capacity of the metal covering having been considered in dimensioning the latter. Thus, for instance, in case of a wire of 2.5 sq. mm cross-section (which corresponds approximately to No. 13 wire B. & S.), the metal cover has a cross-section of 5.5 sq. mm.

As the number of inside conductors of this kind of wire is one, two or three, the total number of conductors will be two, three and four respectively, in case the outer cover is used as a conductor also. Of course, the largest part of the material used is two-conductor wire, which means one or two inner wires, according to whether the outer cover is used as a conductor or not, and for small installations practically only such wire will have to be considered.

Extensive Use of "Kuhlo" Wire

This kind of wire was invented a few years ago by Mr. Kuhlo, director of the electric central station in Stettin, and put on the market on a large scale by the Siemens-Schuckertwerke and named "Kuhlo" wire. A year ago six or seven other firms—among them the Allgemeine Elektricitäts Gesellschaft—took up the manufacture of this wire under the name of "Rohrdraht," which means tube wire.

This Kuhlo wire can be put up in a number of different ways, either buried in the wall or under the surface of the wall. The former is at present not permitted, according to the literal wording of the German

FIG. 35—WIRING INSTALLATION MADE WITH KUHLO WIRE

TABLE III—DETAILS OF CHEAP WIRING SC

	TERRITORY OF SUPPLY		INSTALMENT INSTALLATIONS								INSTALMENTS FOR FIXTURES			GRATUITOUS AND RENTAL INSTALL CASH SUBSIDIES				
	POPULATION	CHARACTER	LIMITS OF SIZE	AMOUNT PER YEAR	PAYABLE	NO. OF YEARS AFTER WHICH CENTRAL STA. WAIVES OWNERSHIP	RATE FOR ENERGY	GUAR. ENERGY CONS. PER YR.	OTHER OBLIGATIONS & ETC. OF CONSUMER.	LAMPS AND FIXTURES	PAY-MENT PER YR	PAYABLE	NO. OF YEARS	LIMITS OF SIZE	RATE FOR ENERGY	GUAR. ENERGY CONS. PER YR.	OTHER OBLIGATIONS & ETC. OF CONSUMER	AMO SU
AACHEN KOHLSCHEID	60,000	18 Villages mining and farming	4 Lamps	ℳ 1.44 per Customer	Monthly, as addit'l to meter-rent	6	9.6₰ Kw-hr.	ℳ 4.30						3 Lamps	Pre-payment 10.80 kw-hr.			Whol article g
ALTONA	130,000	City																
ARNHEM HOLLAND	65,000	City												None	Flat		Apply before Dec. 31st ins	ℳ 4 who
AUSSIG AUSTRIA	50,000	Town	3 Lamps	ℳ 1.00 per Lamp = ℳ 3.00	Monthly	6	Meter or Flat	ℳ 3.00	Only made in the months Feb. to Aug. every year	Excluded								
BESTWIG	8,500	Agricult-ure	INSTALLATIONS AT MONTHLY REPAYMENTS															
BITTERFELD	50,000	Industrial	4 Outlets	1st Outlet ℳ 2.16. 2nd " " 1.00 3rd " " 0.44 4th " " 0.29	Monthly	10	Meter	ℳ 2.88		Excluded								
BLOEMENDAL HOLLAND	30,000		5 Lamps	12% of Cost	Monthly													
BRAND-AACHEN	145,000	Agricult-ural												3 Lamps	Flat		In villages where Flat rate newly introduced	
BARMEN	195,000	City, much Industry	Minimum 2 Lamps	60₰ per Lamp	Monthly	5	Flat		1 Years contract Maintenance	Excluded	INSTALLMENT SYSTEM							
BOCHUM●	580,000	Mining City	15 Lamps	58₰ excl. Fixture, 15₰ simple Fixture	Monthly	5	Meter		1 Years Contract	Included or excluded	INSTALLMENTS							
BORAS SWEDEN	22,000	City												12 light points	Flat or meter (Optional)	ℳ 1.62 per light point	Two years contract	
BREMEN	265,000	City																
BRUEX AUSTRIA	35,000	28 Towns	"Small" Installations	According to cost of installation 50 to 70 ₰ per outlet	Monthly	10	Optional meter or flat		Maintenance									
BUDWEIS AUSTRIA	60,000	City		72₰ per Outlet	Monthly	20			Maintenance Fire Insurance	Excluded	24% of selling Price	Monthly	Indefinite					
COSCHÜTZ	27,000	Laborers																
COETHEN I. ANH.	24,000	City	Minimum 2 Lamps	62₰ per Lamp	Weekly	Indefinitely	Flat		Excl. use of electric light 1 Year fire insurance maint. 5%	Lamps excl. simple fixt. included				Min 2 Lamps	Flat rate 62₰ per lamp years as rent of install. value paid m'ly	Flat rate none but el. light one year		Maintenance, Fire insurance, install. remains property Elec. Light Co
			Minimum 5 Lamps	28₰ per Lamp	Monthly	10	Option		3 Years contract maintenance Fire insurance									
DELFT HOLLAND	34,000	City	Minimum 6 to 8 Lamps	78₰ per Lamp minimum ℳ 240	Yearly	10	Option	ℳ 4.80 (1) ℳ 10.00 (2)	Maintenance	Excluded								
DORTMUND	350,000	City, many Laborers	1-12 Lamps	ℳ 2.30 for distributor board and 58₰ per lamp	Monthly	4	Option		Building connections to lines without heavy expenses, Maintenance	Excluded	About 1/3 of flat price, cheapest fixture 45₰	Monthly	3	1-3 Lamps	Prepayment meter 12₰ per Kw-hr.			Maintenance excl. use electric, cheap connectg. of building must be possible
ELSTERBERG	6,500	Town													Prepayment meter 15₰ per Kw-hr			
DRAMMEN NORWAY	27,900																	
ERBACH i/Odwld	3700		No Limits	40% of Cost	Quarterly	2½	Meter											
GENEVA (SWITZERLAND)	160,000	City, and 18 Villages												1-3 Rooms	18 Kw-hr and 4₰ for all energy above 250 hrs. yearly use	Amount of wiring subsidy		6 years contract, house owner must maintain installation for 10 years
														Above 3 Rooms				
GENOA (ITALY)	350,000	City																Only electric light in kitchen and dining room used
GLAUCHAU ③	33,000	City, and 8 Villages	Residences	72₰ per Lamp	Monthly	6		72₰ per Lamp										
HOECHST a/m	85,000	Overland	1-5 Lamps	1st-3rd Lamp 72₰ 4th " 29₰ 5th " 43₰	Monthly	6			6 years contract for using the installation	Excluded								
ILMENAU	13,000	Town	3-5 Lamps	29₰ per Lamp	Monthly	Indef.	Meter 12₰		Repair, lamp renewal, fuse renewal	Included	(1)	(1)	(1)	3-5 Lamps	Meter 12₰ per kw-hr (normal rate) + 29₰ per lamp per yr. first of install.			Repairs, Lamp renewal, fuse renewal.
				73₰ per Lamp		5												
INSTERBURG	32,000	Town	Minimum 5 Lamps	36₰ per Lamp	Monthly	10	Meter		3 years contract maintenance Fire Insurance	Excluded								

ING SCHEMES IN VARIOUS EUROPEAN CITIES

AND RENTAL INSTALLATIONS AND SH SUBSIDIES				"GRATUITOUS ENERGY" SYSTEM	FLAT RATE					MAX. METER RATE FOR SMALL CONSUMERS	PREPAYMENT METER RATE	METER RENT SMALL CONSUMERS PER YEAR	NOTES	RESULTS
GUAR. ENERGY CONS. PER YR.	OTHER OBLIGATIONS &c. ETC. OF CONSUMER	AMOUNT OF SUBSIDY ETC.	LAMPS AND FIXTURES		LIMITS OF SIZE	RATE PER YEAR: DEMAND LIMITER REDUCED TO 10 W. UNITS	RATE PER YEAR: CONNECT LOAD	PAYABLE	OBLIGATIONS ETC.					
		Whole installation made gratuitously								9.6¢	10.8¢	$1.44		With preceding methods incand. conn. doubled in four years.
					Building Association for laborers flats sells energy at $8.40 per year for 100 watts maximum dem. (2 room apartments 5 sockets) and $8.60 for 110 watts (3 room apartments 6 sockets) demand limiter.									Since Sept. '13
	Apply before Dec. 31st 1913	$4.10 for the whole installation				96¢ per 10 W		Monthly						Since May 1st '13.
							Individual Contracts			12¢		$1.40		In villages of 160 households 85% connected
										9.6¢				
												Max. 87¢		
						$1.45 per 10 W	16 Cp. $2.88 25 " " 4.32			10¢ for heat accumulat. 12-6 A.M. 1½¢		$1.92		3600 Customers from 30000 inhab.
	In villages where flat rate newly introduced	Either 3 lamps at expense of Central Sta. or non repayable subsidy of $10.80	Fixtures Included		60-300 W	96¢ per 10 W (Residences)		Thrice a year or monthly					Jan. 1st 24¢ Apr 1st 34¢ Oct 1st 36¢ } per 10 W	Experimental Stage 270 customers. Result flat rate found very satisfactory. general introduction of flat rate planned
							16 Cp. $1.44 (Ils.) 25 " " 2.28 Etc	Monthly						
														1000's of lamps otherwise not within reach have been conn. shifting population, but certainly 95% of inst. in use
$1.62 per light point	Two years contract	$2.16 per light point		1st yr. grat. current amounting to cost of install. excl. fixture. max. $3.24 p. light point, 2nd yr. consump. $3.24 p. light pt. guar.	20 W-300 W	$1.08 per 10 W		Quarterly		8.7¢ Kw-hr				In 32 months customers increased from 800 to 1750
						94¢ per 10 W		Jan 15th April 15th, Oct. 15th short-circuiting of limiter at 40¢ per night		12¢ Kw-hr		$1.92¢	Jan 15th 28¢ Apr 1st 36¢ Oct. 1st 28¢ 94¢	
							Complicated Schedule	Monthly	1 Year Contract	12¢ Kw-hr		$1.44		In one month $400.00 for installment payments collected from customers
							Complicated Schedule	Monthly						
							25¢ per 5 cp. Carbon			9.6¢		$1.44		2600 flat rate cust'rs. Average small cons 25 W conn.
Flat rate none but el. light one year	Maintenance, Fire insurance, install. remains property Elec. Light Co	Whole installation gratuitous	Lamp excl. Simple fixture included		Minimum 2 Lamps		Schedule abt. 80¢ 10 W	Weekly	Excl. use of electric light one year	9.6¢		$1.44		Satisfactory; Recommend use of flat rate and Installment systems.
				About 50% reduction of rates for 1st year	Maximum 300 W	Schedule on the basis of lamps burning simultaneously		Monthly		Double Rate 8¢/4¢		Double rate meter $4.80	(1) Flat rate (2) Meter rate	
	Maintenance excl. use electric, cheap connecty. of building must be possible	Whole Installation Gratuitously	Excluded. Sold on instalment plan		30-360 W	Abt. 96¢ 10 W		Monthly	1 Years notice, in case of moving 4 weeks	7/9 3/4¢			Sewing mach. motors at 36¢ per mo, Flatirons Varies in the different villages	In 2 months 1000 lamps installed for prepayment meter installations of 2-3 lamp
		Whole Installation Gratuitously												Number of customers rose in two years from 650 to 1150 (Central Sta. 18 Years Old)
				70% discount on 1st years current bill, up to 3 room residences	Small Consumers	40¢ 10 W	4.3¢ per Hefn. Cp.	10 Yearly payments vacations for employees						Number of customers rose 50% in two years
										10.8¢				Introd. Jan. 15th '13. First 10 days 98 applications Total number of cons. previously 400 (Central Sta. 10 years old)
Amount of wiring subsidy	6 years contract, house owner must maintain installation for 10 years	$1.40 (max) with extra of $.40 per lamp if residence occupied Up to cost of wiring, max $2.85 per lamp	Excluded							15¢/4¢			Installation goes into house-owners ownership at once	Good results esp. since 1910 when subsidies for small consumers (1-3 Rooms) without guarantee for current consumption were introduced
	Only electric light in kitchen and dining room used	Max. $2.85 per lamp and not over $7.60 altogether												
						87¢				8.0¢	Very few prepayment meters			
	Repairs, Lamp renewal, fuse renewal.	Whole installation made gratuitous	Included							12¢		58¢	91 Heat and cooking apparatus under instal. ment payments. (monthly) 1 or 5 years	In first 5 months 410 instalment installations added to previous number of 1600 customers (Central Sta. 4 yrs. old
										13.2¢		$1.15		Annually 100 small consumers added. Central Sta. 6 yrs. old 1400 customers

HOECHST a/m	85,000	Overland	1-5 Lamps	1st-3rd Lamp 72¢ L.S. 4th :: 29¢ :: 5th :: 43¢ "	Monthly	6			6 years contract for using the installation	Excluded								
ILMENAU	13,000	Town	3-5 Lamps	29¢ per Lamp / 73¢ per Lamp	Monthly	Indef. / 5	Meter 12¢		Repair, lamp renewal, Fuse renewal	Included	(1)	(1)	(1)	3-5 Lamps	Meter 12¢ per Kw-hr normal rate) + 29¢ per lamp per yr. first of install.		Repairs, Lamp renewal, Fuse renewal.	Whole installation ma gratuitou
INSTERBURG	32,000	Town	Minimum 5 Lamps	36¢ per Lamp	Monthly	10	Meter		3 years contract maintenance Fire Insurance	Excluded								
KIEL	145,000	City																
KLAGENFURT AUSTRIA			Abandoned; considerable increase of business not achieved and central station was not protected against losses in case of tenants moving Municipal works, Gas competition. Fixture installment system maintained								24% of value min℔ 2.40	Monthly	10					
COPENHAGEN DENMARK	470,000	City and Agricult.		23 2¾ of Cost	Quarterly	5	Meter		Fire Insurance	Excluded								
KOENIGS-HUETTE																		
KRISTIANIA NORWAY	250,000	City												Rental Residences	Normal	None	Residences to be lighted electrically throughout	34 ¢ pe aut
LANDSKRONA SWEDEN	16,200	City	No Limits	Repayments in 1-4 years		1-4	Meter			Excluded								
LAURA-HUETTE																		
LIMBURG a/d L			2-4 Lamps	Varying about 30¢ per socket per year, if house connected, otherwise more	Monthly	6	3.6¢ per socket per mo. + 7.2¢ per Kw-hr			Excluded simple fixt: complete sold at 9¢								
LINZ AUSTRIA a/d	100,000	City and Agricult	No Limits	40 ₰ per lamp and 20¢ for additional lamps at same outlet; min. 60¢	Monthly	10	Flat or Meter		3 years contract; maintenance. Fire Insurance	Excluded	20% of list price	Monthly	5 ⅔ yrs, contract for 3 yrs. min.	50 – 300 W	Flat rate increased by 20% for rent of installation	(Flat Rate)		Total i ation c ous; re proper Centra
MANNHEIM	190,000	City	—	100% of Cost	Monthly	1			Maintenance. Fire Insurance	Excluded								
MILAN ITALY	Approx 600,000	City	PLANNED											Small-est Resid-ences	Flat rate incl. rent of instl.	(Flat Rate)		Total i ation c ously, pr proper Centra
MÜHLHAU-SEN i/Thuer	35,000	City												Max. 5-lamps	Prepay-ment Meter	ℳ 1.44 per Fixture	Maintenance renewals 1 years contract	Total i gratui remai erty o Ce
MUELHAU-SEN i/E	275,000	All Towns and Villages	Meter Rate 2-5 Lamps	1st Lamp free the rest at 72¢ per lamp	Monthly	6	Meter	ℳ 4.50 per install. for 3yrs. renew. 80₰	3 years contract Repairs	Excluded	29¢ Simple fixture and lamp	Monthly	6					
			Flat Rate max. 250 W. 2→ Lamps	72¢ per Lamp	Monthly	6	Flat		6 years contract, repair ren.									
OBERSCHLES EL. WERKE	650,000	56 forena Industry																
OPPELN	34,000	City	NOT YET								26 ⅔ % of selling price	Quarterly	8				NOT YET	
ORANIENBURG	15,000	Town	No Limits	48¢ per Lamp	First year in advance in full, then quarterly	10	Meter or flat		3 Years Contract	Excluded	10% of selling price	1 Yr. in advance in full, then quarterly	5% interest adv. 13 yrs.					
POTSDAM	103,000	16 Towns	Small Apartments (2-Rooms and) Kitchen	1st lamp free every following one 72¢	Monthly	6	Meter or Flat	ℳ 5.05		Fixture in kitchen Included, otherwise excluded.								
SCHLETTSTADT	10,000		First Three Lamps	36¢ per Lamp	Yearly	6	Meter	ℳ 4.30 Yearly for 6 years	6 Years contract except if cust. moves during that time. (Repair central sta. expense)	Excluded								
SCHOENEBERG	300,000	Parts of Berlin	Minimum ℳ 18.— per Year	20% of Cost) 96¢ per Lamp	Monthly	7	Meter or Flat		3 years contract maintenance. Fire Insurance	Excluded				1-3 Rms. 1 circuit only max. 20 lamps	Flat rate of min. 80, 120 or 160 ℳ per month for 1, 2, 3 rm. flats resp. at 72 ₰ per 10 m	Flat-Rate 1 Years contract	1 Years contract one half of the flats on one riser must apply	Either instal subsc ℳ 200 for 1 flats

					87¢				9.0¢	Very few prepayment meters				
epairs, Lamp renewal, use renewal.	Whole installation made gratuitous	Included							12¢		58¢	(1) Heat and cooking apparatus under installment payments. (monthly) for 5 years	In first 5 months 420 installment installations added to previous number of 1600 customers (Central Sta. 4yrs. old	
									13.2¢		$1.15		Annually 100 small consumers added. Central Sta. 9 yrs. old 1400 customers	
				30¢ 100W	$1.15		3 annual instalments		13.2¢				Since april 1st 1913	
						complicated Schedule, adm. 3-144 per cap. yr.	Monthly (1) very small sums also quarterly, yearly		8¢			(1) Flat rates for very small residences collected from house owner, and the latter is considered the consumer		
									8.5¢		$1.62			
				30 - 800 W	Combination				7.2¢		$1.44	(1) For inst. 30 W max. demand. 30 W conn. $3.15 60 W conn. $4.40 etc	About ½ of consumers on flat rate	
esidences to e lighted ectrically roughout	3¢ per outlet			25 - 300 W. max. 4 lamps	5¢ per 10 W. +18¢ for limiter			one yrs. contract	7¢		$1.62	consumers can switch over to meter at 9.1¢ per kw-hr	Jan. 1st 1912. 11900 flat rate consumers	
									9.5¢		None			
				50 - 1000 W.	72¢ (upto 100 W) larger cust less		Quarterly		6¢ (1)		?	(1) Collected from house owner for all tenants on one bill	Large increase in number of small custumers in 1910 when flat rate was introduced	
									13.3¢ or 7.2¢ + 3.6¢ per sock. per mo.		$1.44			
	Total installation gratuitous, remains property of Central Sta.	Included (renewals excluded)			$1.20 at least 40% of conn ld		Monthly	Short-cir of limiter at 30¢ per night	18¢ If more than 100 kw-hrs. p.q 5% discount		$1.20			
			In installment installations a certain number of kw-hrs during first year free		In Preparation									
	Total installation gratuitously, remains property of Central Sta.	Included (renewals excluded)			$1.36 - 2.40 according to size of lamp etc including rent of installations		Monthly							
Maintenance renewals 1 ars contract	Total install. gratuitous; remains property of Central Sta.	Included (renewals excluded)												
				250 W. max. 2-4 lamps	$1.20 at least 50% conn load		Monthly		9.6¢		87¢		Within 2 years 3000 new consumers under installment installation. previous number of cons. abt 5000 Central Sta. 25 yrs old	
				Min. 30 W	72¢ upto 100 W larger cust less				8.8¢/kwright				18000 flat rate consumers, 2500 meter cons.	
NOT YET														
				Min. 2 lamps. 50 W.	86¢		Monthly	only electric light one year, only metallic filament lamps	9.6¢		$1.72	(1) 6 lamps if building not connected		
				60 - 500 W	72¢ per 10 W+ fixed charge of 72¢		Monthly (1) Quarterly (2)	None but electric light one yr.	9.6¢			(1) with (2) without } instalment installation		
									9.6¢		72¢		In less than one year 1400 applications for installment installations. Previous number of cust. 900 Cent. Sta. 10 yrs. old	
ears contract e half of the ats on one er must pply	Either whole instal. grat. or subsidy of $9.60, $12.00 and $14.00 for 1, 2 and 3 rms flats resp.	Excluded		Max. 3 Rooms	72¢		Monthly	1 Years Contract	38¢		$2.40	(1) Wiring made accord. to Spec of consumer. (2) Is made accord. to Judgment of Cent Sta (3) Instal. remains property of Cent. Sta.	Flat rate since July 1st '08. 100 Applications in less than 1st 3 months	

SCHLETTSTADT	10,000		First Three Lamps	36¢ per Lamp	Yearly	6	Meter	ℳ4.30 Yearly for 6 years	6 Years contract except if cust. moves during that time. (Rep. at central stn. expense)	Excluded								
SCHOENEBERG	300,000	Parts of Berlin	Minimum ℳ18.— per Year	20% of Cost)[1] 90¢ per Lamp[2]	Monthly	7	Meter or Flat		3 years contract maintenance. Fire Insurance	Excluded				1-3 Rms. (circuit only) max. 20 lamps	Flat rate of min. 80, 120 or 160 ℳ per 12 months for 12, 8 sm. flats resp. at 12 ¢ per 10 W	Flat Rate 1 Years contract	1 Years contract one half of the flats on one riser must apply	
STEGLITZ (BERLIN)	180,000	14 Suburbs																
STETTIN	240,000	City	Max. 12 lamps installed	29¢ per lamp	Monthly 1st yr. total in advance	10	Flat Rate		Pay instalments and flat rate in advance for whole first yr; Maintenance	Lamps excluded Simple Fixtures included								
STOLP	34,000	Town	Min. ℳ 1.44 per yr.	Simple one-way switch 38¢ per Lamp	Quarterly	10	Flat or Meter		Maintenance	Excluded								
STRASSBURG 1/E	165,000	City	(City) 1-4 Lamps	1st Lamp Free 72¢ per lamp	Monthly	8	Meter	ℳ 4.50		Excluded								
	185,000	Agricultural	(Country) 3 Lamps only	No Free Lamp, 72¢ per lamp	Yearly Max 12	6	Meter	ℳ 3.60	3 yrs. Contract	Excluded								
	166 Villages		(Country) No Standard Limits	Repayment of cost in 1-3 yrs	Individual Agreements	1-3 yrs	Meter		Generally 3 yrs. Contract	Included								
TILSIT	45,000	5 Towns	Max. 4 outlets	60¢ per outlet[1]	Monthly, Less in summer and more in winter	5	Hopkinson Demand kw-hr charge at 7.5 ¢, Meter rent waived			Excluded, Fixtures sold at extra low prices								
TRIER	54,000 + 33,000	city + 28 villages												Varies in different villages a non-rep ℳ 1 to 2 per lamp (max. 2 lamps) if cust within 3 months after his village is conn (Originally 96 ¢ for every lamp) [no max.				
TRONDHJEM (NORWAY)	46000	City	No Limits	53.6 per lamp payable by house owner	Yearly	6	Mostly Flat	ℳ 1.08 per Lamp	Maintenance Fire Insurance									
VILLACH AUSTRIA	25,000	Town	Limits required only for small residences	8% of Cost	Monthly	10[1]	Meter and Flat		Maintenance (Fire Insurance paid by Central Stn.	Lamps excl. Fixtures included								
WARBURG	6000	Industry, Agriculture	3-5 Lamps	29¢ per Lamp	Monthly	6 yrs, 8 months	Meter		Contr. for 6 3/4 yrs. houseowners guarantee payment if residence vacant	Included								
VIENNA AUSTRIA	2,100,000	City	No Limits	Min. of Average of ℳ 2.16 per outlet[2]	Prepayment meter	5	Prepayment meter, rate raised 100% for paym. of instaln.	380 hrs use	Maintenance contracts for 5 yrs., but not longer than until cust. moves	Included, also lamp renewals				Shops only burning 650 hrs. per yr.	Flat rate as follows			W at
WERDAU	103,000	48 Towns, Industrial and Agricultural	Min. ℳ 1.80 per yr.	36¢ per Lamp	Monthly	10	Hopkinson demand		1 Years Contract	Excluded								
			2 Lamps if house not yet connected	43¢ per Lamp	Monthly	Interminate	Hopkins. demand at flat rate		3 Yrs. contract. Maintenance Fire Insurance	Lamp excl. simple fixture incl.								
ZARA (DALMATIA) AUSTRIA	13,000	Town	No Limits[1]	12% of Cost	Monthly	Interminate	Wright Demand		Maintenance done by Cent. Stn. at lamp sum + 24 ¢ per yr. for installation up to 10 lamps	Excluded								See preceding
ZWICKAU (OELSNITZ)	20,000	Mining and Industrial town	Meter Rate from 1 lamp up No limits	43¢ per lamp first lamp free	Monthly	5	Meter		5 yrs. contract (waived if cust moves) no gas introduced during contract	Lamps excluded; Fixture included Lamp renewals at extra low price	Heating and Cooking Appliances: 12½% of Price	Monthly	Remain property of Cent. Stn.					
			Flat rate (house owners only) 1-5 Lamps	43¢ per lamp first lamp 72¢	Monthly	5	Flat		5 yrs. contract (suspended as long as Flat 13, vacant)									
GOTHENBURG SWEDEN	160,000	City																

On account of limited space, all Regulations could not be included in this table. Slight changes made where necessary, which do not alter the essentials; for instance flat rates reduc

										9.6¢		72¢		1400 applications for installment installations. Previous number of cust: 900 Cent. Sta. 10 yrs. old
1 Years contract one half of the flats on one riser must apply	Either whole instal. grat [3] or subsidy of $9.60, $12.00 and $14.00 for 1, 2 and 3 rms flats resp.	Excluded		Max. 3 Rooms	72¢		Monthly	1 Years Contract	36¢		$2.40	(1) Wiring made accord. to Spec. of consumer. (2) It made accord. to Judgment of Centrale (3) Install. remains property of Cent. Sta.	Flat rate since July 1st 1910. 100 Applications in less than 1st 3 months
				50-500 W	86¢		Quarterly					(1) April 1st and July 1st 17¢, Oct. 1st and (2) Jan. 1st, 26¢.	
				30-200 Watts	96¢		Monthly		12¢		$1.44	(1) Limiter can be short-circuited and kw-hrs. paid at 12¢ kw-hr. on basis of max. possible excess load and hrs. short-circuited (Time meter) (2) Flat rate on basis of meter readings of preceding yr. only, with disc. of 10% on reg. meter rate	Not yet available, system only recently introduced
				Above 200 watts	96¢		Monthly						
				Max. 100 W	$1.01 - 1.08		Quarterly; Summer 1/4 Winter 3/4	Contract for min. 50% of conn. load	10.1¢		$1.44		
				Min. 2 Lamps		C.P. Schedule for inst. 30 c.p. $1.44	Monthly	Show-Windows only, 3 yrs. contract	9.6¢		72¢		Jan 1st 1913. 13700 consumers with instalment installations. In the city and some parts of the Surrounding country (See Text of Report)
				SHOW WINDOWS ONLY									
									6¢ + 60¢ per yr. per outlet (Hopkinson)		87¢ waived with instalment installations against increase of kw-hr. charge	(1) If at least 3 outlets, one receptacle for flat-irons, cooking appliances etc. wired free of charge	Introduced 1910. Connected In: 1910 : 1 Installment Inst. 1911 : 47 " " 1912 : 158 " " 1913 : 228* " " 434 Total * First nine months
villages a non-repayable subsidy of max. 2 lamps) if customer connects his village is connected to the system. very lamp) [no max. number]				60-300 W	86¢		Jan. 1st Apr. 1st Oct. 1st 1/3 each		10¢		$1.44		See Table I of Report
					Bath Limiter and conn. load about 43¢		Limiter: 10 yearly inst. allments. conn. Load: 6 yearly instalments						**Installment installations since May, 1912; 95 in 16 months**
						Complicated Schedule			3¢		$2.00	(1) Would really be 10yrs. (at 3 a 5%) but profit from current sale used for amortization also	No considerable results yet, central station only 2 years old and busy with applications & cost of consumer
									9.6¢		72¢		
		Whole Installation gratuitous	Included; also renewals of 10 lamps per yr.	Shops only burning 650 hrs. per yr		30 c.p. $2.60 [1] 55 " " 13.20 75 " " 18.00	Monthly			14½¢ kw-hr. for current + 14½¢ kw-hr. for rent of installation		(1) Collected by stipulating a supplementary "payment" of 0.6¢ per outlet for every hour use short 360 hours per year (2) Include rent for wiring and fixtures and renewal of 10 lamps per socket per year. Time meter installed, excess over 650 burning hours paid according to size of lamp.	
					Ab't 55-65¢ in Residences				13.2¢ on [1] $2.20 per kw conn + 2.4¢ kw-hr.		86¢	(1) For residences, other figures for stores etc.	8000 out of a total of 12,000 consumers have installations of Central Sta. expense, of which 1500 using instalment-installations (existing since 1908) and 6500 Grat. Install. (since 1909) of the latter 5000 Flat rate Install. a 1500 Hopkinson
See preceding									16¢ (Paid by very few consumers)			(1) The average small customer has 2 lamps installed	
				No Limits		First 32 c.p. lamp $2.88, 2nd $1.73 (1) 3rd and following ones @ 1.30 1st 16 c.p. lamp 1.15, following ones 87¢	Monthly or Yearly	5 yrs. contract; waived if cust. moves; (gas not allowed)				(1) First lamp must be 32 c.p.	In 1912 abt 7000 new lamps connected for small consrs. bringing yearly revenue of $ and on capital invested there for $12000 for Installns. Av. small cons. 50w inst after 3½ yrs. @ 24000 for Instls. which secure ann. income of $ 21,000
			Gratuitous current one year not exceeding amount of cost of installation (current comp'd at meter rate 9¢ kwhr.		93¢; if every room of laborers tenement one lamp installed and one limiter only for whole building, rate reduced to 81¢				9.4¢				Number of customers rise in after introduction of system within about 3 yrs. from 4800 to 12,000. 18.2% gross returns. particulars &c. see Intext of report

tance flat rates reduced to 10 watt units throughout, even if expressed otherwise in schedule. Residences considered in first place. All places where country is not stated are in Germany.

rules, which were made before the general introduction of the Kuhlo wire, but in practice the scruples against burying wires in plaster do not seem to be shared generally, and many wiremen are concealing the Kuhlo wire when occasion demands. For this purpose a particular instrument, consisting of two 4-in. saws riveted together in parallel position so as to leave a space of

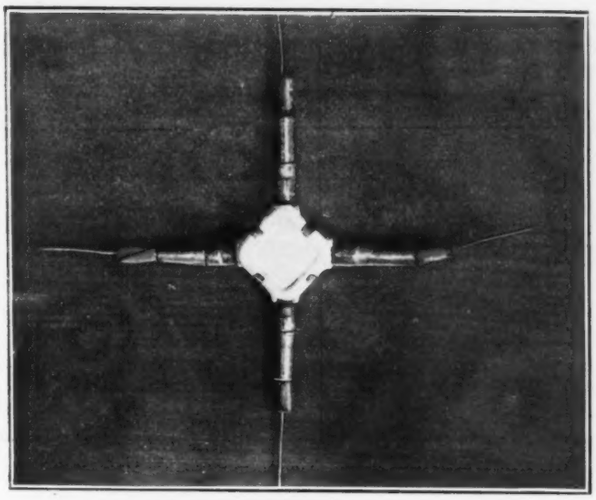


FIG. 36—SINGLE-POLE SOLDERED CROSS-PIECE WITH KUHLO WIRE

about ¼ in. between them, is used. This double saw cuts a very nice, clean groove into the mortar on the wall, especially when guided by a straight-edge. The Kuhlo wire can then be placed in this groove and plastered up.

In most cases, however, it is preferable to fasten the Kuhlo wire to the surface of the wall, not only for reasons of greater cheapness, but also because less disturbance and dirt will be caused that way in finished buildings with painted or papered walls. Kuhlo wire is unobtrusive in appearance, the thinnest wire with single conductor (capable of carrying 6 amp under the German rules) having an outer diameter of only 4.3 mm, or less than 3/16 in. Moreover, this wire can be run in the corners of rooms or along the frames of doors and windows and picture molding, etc., thus rendering the installation less visible.

There are several methods in use for fixing Kuhlo wires to the surface of a wall, the simplest being to nail it down with proper staples. Other methods are permitted by the German rules, such as holding the wire down by straps which are made of brass-covered or lead-covered iron, in accordance with the material covering the Kuhlo wire. These straps have lugs on one side with holes in them. A piece of square steel of about 1¼-in. length is driven into the brick wall until it is flush with its surface. The strap mentioned above is then screwed down on the wall by means of a small iron machine screw into the center of the square piece of steel tapped for that purpose (Fig. 32). Before screwing the strap down the Kuhlo wire is passed under it and then held in place. Instead of having rigid straps to fit the Kuhlo wire, flexible brass straps may also be used (Fig. 32) which are bent around the wire after one end is screwed onto the square piece of steel, as mentioned before. This has the advantage that the square pieces of steel can be driven into the wall along the path of the wire whereas with the first-named type of straps the square pieces of steel have to be driven in about ⅜ in. or ½ in. to the side of that line. These flexible straps, which are rolled around the wire by hand, do not look quite so neat and tidy as the others, but are good enough, especially if cheapness is the first consideration.

By a third method the Kuhlo wire is held to the wall with little soft brass fork-shaped supports (Fig. 32) which also are screwed into the pieces of square steel and then pressed by means of pliers around the wire. On ceilings it is sometimes preferred to carry the wire about 2 in. or 2½ in. away from the surface, in order to avoid plastic ornaments which may happen to be on the ceiling. The illustration also shows such carriers screwed into the ceiling and holding the wire by means of clamps.

The outlet boxes for residences are made of porcelain. Where mechanical abuse is likely, or in dusty places, metal outer boxes are used, consisting of cast-iron bases with tight-fitting brass covers kept in place by friction.

The porcelain fittings used for residence and other lighter work are of two types—one for soldered and the other for screwed connections. Both types have a sheet-brass base under the porcelain parts, which insures good electrical connection between the outer covers of all the wires entering into that outlet box, which connection, of course, is essential in case the metal coverings form part of the circuit. The connection between the sheet-brass base of the outlet boxes and the outer conductors of the Kuhlo wire is made in the same way as that of the inner conductors, namely, soldered or screwed, depending on the type of fitting used. The porcelain fittings, especially of the soldered type, are very small and unobtrusive in appearance. Fig. 31 shows a T-connection box with the cover off for connecting an ordinary single-pole switch into a horizontal one-wire conductor with grounded return circuits. The length of the porcelain piece is only 1⅜ in. As can be seen, the vertical conductor which leads to the switch must be, of course, a two-wire conductor, since the return circuit passes unbroken through the metallic base of the T-fitting, and it is not necessary to carry the grounded return circuit to the switch at all. Fig. 36 shows a single-pole soldered cross-piece.

As regards the necessary curvature of the wire, the smaller types of single and double conductor, which are almost exclusively used in ordinary house wiring, can be bent by hand. Stronger wires have to be bent by means of a special tool (Fig. 40).

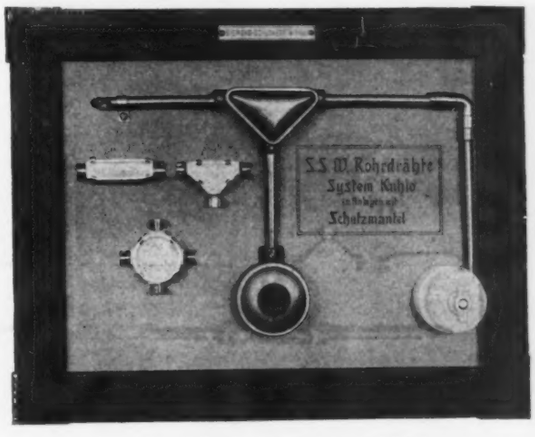


FIG. 37—KUHLO WIRING FITTINGS

Another handy tool for Kuhlo wire is a pair of special pliers used when stripping the wire of its cover at the ends (Fig. 41). This tool has a set of semi-circular grooves corresponding to different diameters of wire, which grip the wire tightly. These pliers are used solely to hold the wire and prevent tearing off the covering for a greater length than intended.

One of the great advantages of this method of wiring is its cheapness. When the method was new a prize competition was arranged and it was discovered that one wireman could run 200 ft. of Kuhlo wire per day. Since that time a record has been set of 650 ft. a day per wireman. Of course, the wiremen must be trained to the work and become thoroughly accustomed to it

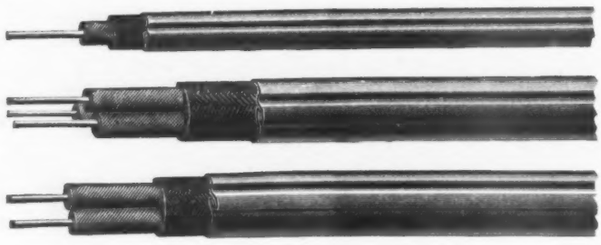


FIG. 38—TYPES OF KUHLO WIRE

before proper comparisons as to the cost of wiring can be made.

Many other kinds of installations besides residences have been wired on the Kuhlo system, such as public buildings, theaters, churches, schools, hospitals, factories, agricultural establishments, offices, hotels, castles, villas, also ships and railway cars, and work of this kind is still increasing. Kuhlo wire is not found to any great extent outside of Germany.

Wiring Practice in England

A few words may be of interest regarding the wiring methods found in England. A very large proportion, which at a rough guess might be said to be 50 per cent, is of the so-called slip-joint tube wiring; that is, tubing which is not screwed. There are two distinct types of plain tubing, the first and cheapest type consisting of a flat piece of steel bent into circular form so that the edges butt only. This is known as split or closed-joint tubing. The second type is made up in the same manner except that in addition the edges are brazed together. It is known as brazed tubing. The fittings are either of cast steel or stamped.

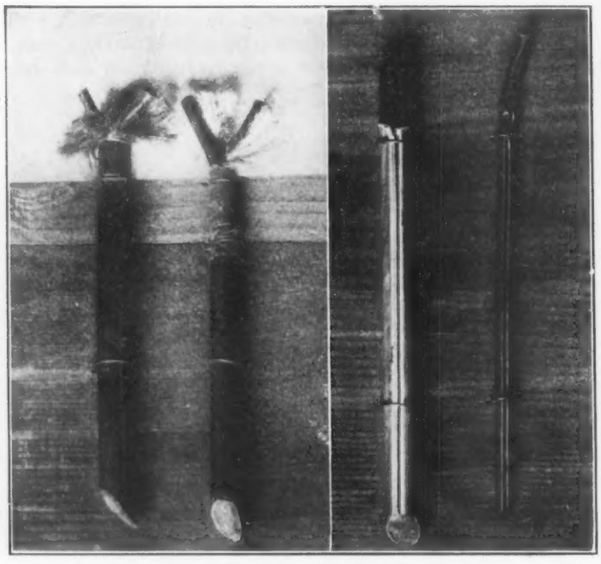


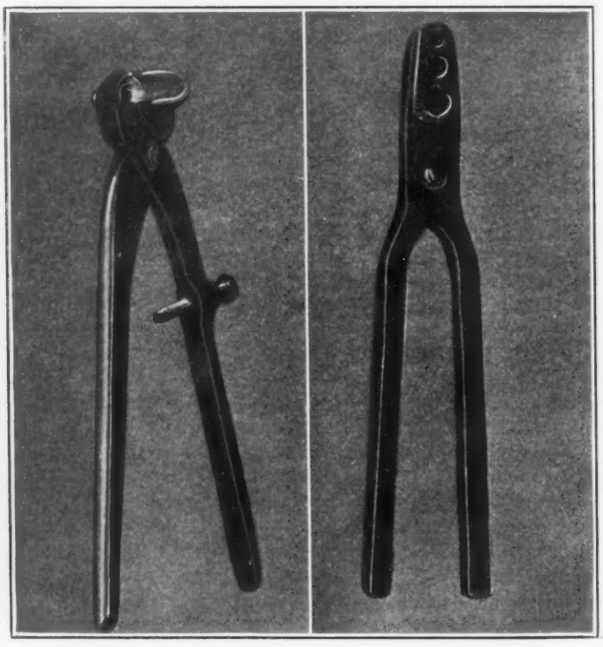
FIG. 39—INEXPENSIVE BRASS-COVERED CABLE

Wooden molding is also used to a large extent in England, and still more so in France and Italy, whereas it is absolutely forbidden by the German and Austrian rules. It seems that in England also it is going out of use in favor of "Stannos" screwed tubing and wire-armored twin conductor.

The so-called "Stannos" wire is equivalent to the Kuhlo wire in Germany. It consists of a rubber-insulated copper wire covered by a thin copper sheet which is rolled around the rubber in several layers (lengthwise, not in spirals) which are soldered together afterward, so as to form a solid, water-tight, seamless, tin-covered copper tube. The Kuhlo wire is a later type and is an improvement in so far as the price is cheaper. It is not considered in Germany to be inferior to the Stannos wire. The fact that Stannos wire, which was also put on the market by the Siemens concern, the same as Kuhlo wire, is used more in its native country, England, whereas the German Kuhlo wire is used more in Germany, may be due to climatic as well as to commercial causes, inasmuch as the moist weather prevailing in England may make an absolutely water-tight wiring material more advisable.

Screwed tubing is used for very high-priced work and is either welded or solid-brazed or solid-drawn. Wire-armored twin conductors are considered most promising, but at present are too expensive. Flexible twin cord on glass or porcelain knobs was never much employed in Great Britain on account of the inferior quality of this kind of wiring and is going out of use, just as in Germany and Austria.

Brief mention may be made here of the so-called cab-tire sheathed cable, which, although not much employed for inside installations, still may be found interesting. Each conductor of this cable is insulated with pure vulcanized india rubber, then sheathed with one layer of tough rubber, called by the makers cab-tire sheathing; this is put on under heavy pressure. The cable is made either in single-conductor, twin or multiple, the separately insulated conductors in such cases being laid together and sheathed over all. This sheathing is exceedingly tough; it is waterproof and resists the action of steam, oils, acid and alkaloids. Moreover, the sheath prevents the cable from becoming kinked. It can be used for ordinary flexible cords, for hand-lamps, etc., and for house-wiring work, being attached by means of suitable brass saddles.



FIGS. 40 AND 41—PLIERS USED WITH KUHLO WIRE

Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

Poor Shaft Alignment

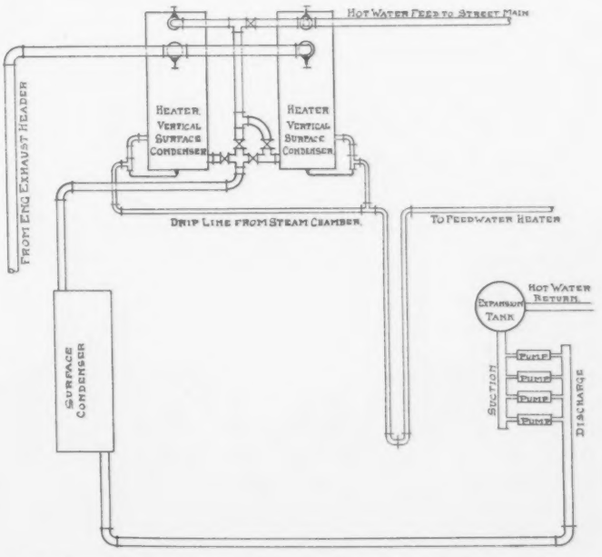
Even with the best of shaft alignment it has been found profitable in many cases to substitute individual motor drive for engine drive. This is not only to give individual speed control but to eliminate ever-present bearing and belt losses. Furthermore, the low-water rating of hydraulic plants has been increased by applying the waterwheel to drive a generator for motor supply instead of having the wheel drive the mill shafting direct. An inspector was called in to find out why an induction motor got "so hot when the cornmeal machine was thrown on." The motor drove 30 ft. of shafting the hangers of which were lagged to the floor. To the shafting were belted the meal grinder and several smaller machines. With only the smaller machines working, the motor was running supposedly light. The ammeter showed, however, that under this condition the motor was fully loaded and that throwing out the small machines did not appreciably affect the load, but that throwing in the grinder increased the load 50 per cent. The cause of the overload was traced to sacks of corn and meal piled so high upon the floor as to sag it and pull the shaft hangers out of line, the shaft then taking the shape of a letter S in three dimensions. The mill operator unloaded the floor so that the hangers could spring almost back into line, then braced the floor from beneath so that it could stand a load without sagging. Application of the ammeters then showed that the motor was just loaded when all machines were in operation. The inspector got his clew to the trouble from a couple of very hot hanger boxes.

Gradual Overloading

One accustomed to engine drive and who adopts electric-motor drive is usually solicitous about having a motor sufficiently large for the work, and this is especially likely to be so after he has compared the size of the engine with that of the motor that is to replace it. Once the motor has been installed and has shown what it can do, however, all solicitations as to the possibility of overloading the motor seem to end, and one machine after another is added to its load without a thought as to its welfare. The case of a 5-hp induction motor the original duty of which was to operate one small beam hammer and a blower for two forges is typical. Three forges were added, one at a time, and the size of the blower was doubled; then another small beam hammer was added; then a drill press and a large beam hammer. Each addition called for another belt, and the total length of shafting was doubled. Then the inspector was called to find out why the motor blew fuses "when the big hammer was thrown on." The compensator was connected on the highest tap, yet the motor required one and one-half minutes to come to the highest speed obtainable on the starting side of the compensator. It should have required about thirty seconds. Ammeters connected into each of two legs showed that the full motor current rating was required to run the shafting, belts and blower, and that under average operating conditions the motor was just 100 per cent overloaded. On account of the heavy overload the difference between the maximum speed obtainable on the starting side of the compensator and that on the running side was so great that throwing the compensator over would blow all fuses.

Combination Water-Heating System at Springfield, Ill.

In order to supply hot water to the 336,000 sq. ft. of radiating surface on its hot-water-heating system the Springfield (Ill.) Light, Heat & Power Company uses surface condensers operating in connection with cross-compound condensing engines and vertical heaters arranged to be operated singly, in parallel or in series. The temperature of the water in the heating system is, of course, regulated to accord with the temperature out of doors. Fundamental variations in water temperature are produced by varying the vacuum in



ARRANGEMENT OF SPRINGFIELD HOT-WATER HEATING SYSTEM

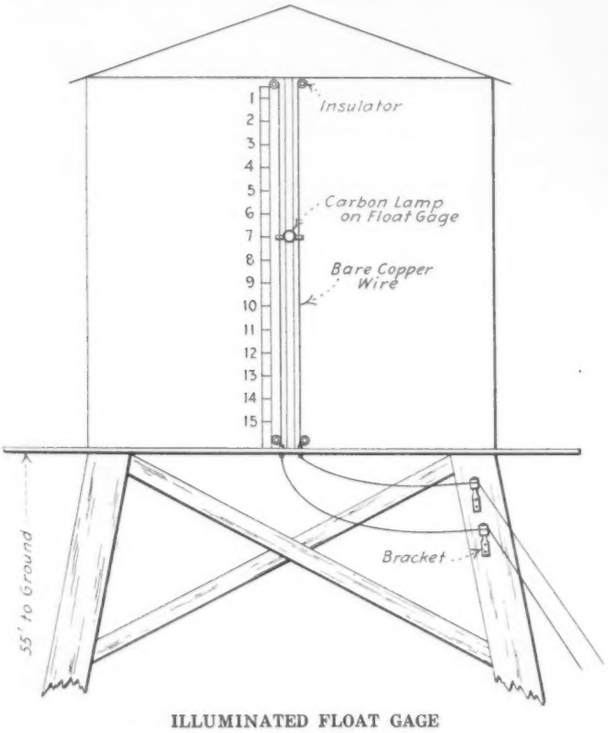
the surface condensers, the vacuum gage on these condensers being allowed to fall at times as low as 10 in. of mercury. As additional heat is required beyond this point the water is circulated through the vertical heaters and brought up to the desired temperature by the use of exhaust steam brought in from the engine exhaust header.

Circulation of the water through the system and return to the expansion tank is accomplished by three reciprocating pumps and one turbine-driven centrifugal pump. Within a short time the three reciprocating pumps will be replaced by turbine-driven units. Mr. R. E. Hagenah is superintendent and chief engineer for the company.

Illuminated Float Gage Saves Water

Water for boiler-feed and condensing purposes, for transformer cooling and for plant service in an Ohio central station is supplied from deep wells driven on the company's property. For the first three uses the water is taken directly from the wells, but for house service the supply is first pumped to a tank which stands outside the plant, at a height of 55 ft. above the ground. As most of the pumping for the house-service tank is done at night when the station load is light some means of reading the water level in the overhead tank in the dark had to be devised in order that water might be saved and the operating expense kept at a minimum.

As will be seen from the accompanying sketch, a small carbon lamp was attached to the water-level indicator and bare-copper wires were stretched between insulators

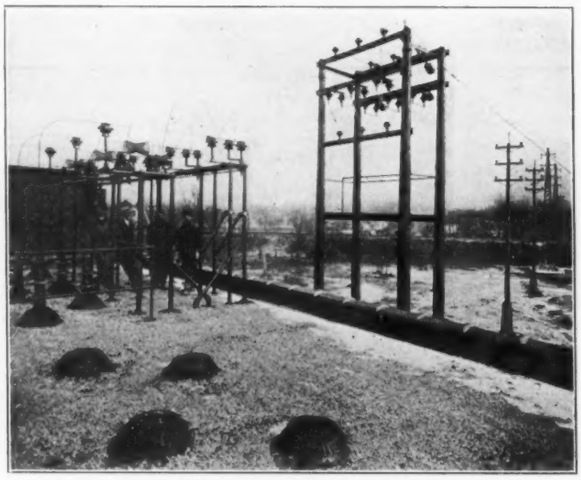


ILLUMINATED FLOAT GAGE

at the top and bottom of the tank. Contactors were then arranged at all times energizing the filament of the lamp. As the float indicator moves up and down the scale it carries with it the lighted lamp illuminating the numeral opposite. The circuit is controlled by a switch near the boiler-room door, through which the engineer has to pass when going to see the scale on the tank.

An Inexpensive and Substantial Pole Base

To the man who has to do the climbing a spliced pole is always more or less of a necessary evil. It is not, however, always practicable for the central-station company to buy a few high poles for the sole purpose of grading a line or going over an obstruction; hence spliced poles are often found. The idea that a spliced pole is always necessary has been exploded by the scheme used by the Elwood (Ind.) Electric Light Company on two poles which were set between the station disconnecting switches and two high towers used to clear the wires on the nearby railroad right-of-way. In this instance the length of span demanded that two poles be set in the low ground between the station and the railroad embankment. As it would have been necessary to set the poles in concrete, regardless of their height, on account of the water which runs through the low ground during the spring freshets, it was decided to continue the concrete to a point which would make a splice unnecessary. The poles as they stand present a neat appearance and do not offer the



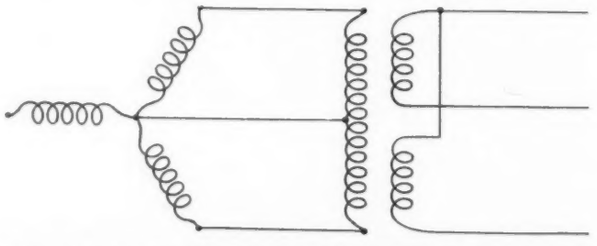
POLES ON HIGH CONCRETE BASES

difficulties to the climbing lineman which are met with in the ordinary spliced pole. The stability of the poles was tested during recent floods when the water stood nearly at the top of the concrete base. Some apprehension was felt for the new type of construction at that time, but the subsiding water left the poles as upright as it had found them.

Transformer Connections to Change Phase Relations

Can two single-phase transformers be connected in open delta across a four-wire grounded-neutral three-phase system to deliver three-phase energy? O. M. P.

The connection of single-phase transformers to deliver three-phase energy when in open delta across the outer terminals of a four-wire grounded neutral system is the same as would be used if no neutral were employed. If, however, it is desired to connect single-phase units in open delta between two outer terminals and the neutral, the connections have to be made as shown in the sketch to obtain three-phase energy. To obtain a power output with an open-delta connection



THREE-PHASE TRANSFORMER CONNECTIONS FROM NEUTRAL POINT

equivalent to that with three transformers connected in closed delta, use should be made of two units each having about 73 per cent larger rating than those in the former case. In any event the voltage under load will be distorted from the true three-phase relation by reason of the lack of equality in the impedances in the various circuits.

Digest of Current Electrical Literature

Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

Generators, Motors and Transformers

Three-Phase Series Commutator Motors.—OSKAR SRNKA.—The use of the three-phase series commutator motor is increasing in favor especially on account of the possibility of regulating the speed without losses at any load. If these motors are to be used for traction purposes, the question of recuperating energy during braking becomes of increased importance. The author shows how the three-phase series commutator motor with an intermediary transformer and a double set of brushes can be used to return energy into the network.—*Elek. u. Masch.* (Vienna), May 3, 1914.

Lamps and Lighting

Rating of Lamps.—The German Illuminating Engineering Society proposes to rate the candle-power of a lamp by one of the following three quantities: The mean spherical candle-power J_o, the mean low hemispherical candle-power J_u, and the mean horizontal candle-power J_h. It must always be stated which of these three candle-powers is meant. From a purely physical viewpoint the mean spherical candle-power is the most important one, but for practical reasons it is often advisable to stick to the ratings by lower hemispherical candle-power and horizontal candle-power. The committee recommends stating the conversion factors for changing the mean horizontal and the mean lower horizontal candle-power into mean spherical candle-power. This report of the committee is preliminary, and it is intended to bring about an agreement with other societies, especially the Association of Electrical Engineers. —*Elek. Zeit., April* 30, 1914.

"Objective Photometry."—VOEGE.—A paper read before the German Illuminating Engineering Society. The purpose of an objective photometer is to make the routine photometer tests in factories and laboratories independent of the human eye by means of a simple galvanometer reading. Since the thermo-element and the bolometer are not sufficiently sensitive for light rays and the selenium cell has too much inertia, the author uses the photo-electric alkali cell. This consists of a spherical glass vessel filled with argon. One wall is covered with a metallic potassium or sodium layer forming the cathode, while the anode is formed by a platinum wire. When the cell is illuminated by light and an emf is impressed on the cell electrons are emitted by the potassium layer, producing a current which is weak but can easily be measured. This current is proportional to the illumination within the widest limits, from 0.0001 lux to 80,000 lux. The cell is free from inertia. Its chief disadvantage is that the maximum sensitiveness is in the blue-violet part of the spectrum while that of the eye is in the yellow-green part. To overcome this difficulty the author uses suitable light filters whereby the maximum of the sensitiveness of the cell is made to coincide with that of the eye, although the sensibility curves are not yet entirely identical. The results obtained for practical purposes with the photo-electric cell are identical with those of a photometer as shown by Table I, which gives the results for a carbon-filament lamp and a tungsten lamp at different voltages. The table gives the candle-powers determined by the photo-electric cell and the photometer and their differences. The differences are entirely within the limits of experimental error. Fig. 1 shows the experimental arrangement. The photo-electric cell Z is connected in series with the battery E and the galvanometer G, which is calibrated in candle-power. First the standard lamp is inserted at N and the distance a is so adjusted that the galvanometer needle gives the correct value for the standard lamp. If the lamps to be tested are substituted for the standard lamp N, the galvanometer gives directly the candle-power. The voltage of the photo-electric cell should be between 60 volts and 120 volts, according to the sensitiveness required. The sensitiveness increases rapidly with increasing voltage. E is a battery of small cells. Hardly any current is taken from them during the measurement. The method is useful for tests of electric incandescent lamps, for photometry of gas incandescent lamps, for tests of small hand and pocket lamps, etc.—*Elek. Zeit.*, April 30, 1914.

RELATIVE DATA ON CANDLE-POWER

	Candle-Power		Difference,
	Potassium Cell	Photometric	Per Cent
Carbon-filament lamps:			
85 volts	5.85	6.00	— 2.5
90 volts	8.53	8.57	— 0.4
95 volts	12.25	12.37	— 0.98
100 volts	17.00	17.06	— 0.35
105 volts	23.26	23.18	+ 0.35
110 volts	31.00	31.00	0
Tungsten lamps:			
110 volts	25.00	25.00	0
115 volts	29.62	29.60	+ 0.07
120 volts	34.70	34.90	— 0.57
125 volts	40.10	39.70	+ 1.0
130 volts	46.25	46.60	— 0.75
135 volts	52.30	52.00	+ 0.6

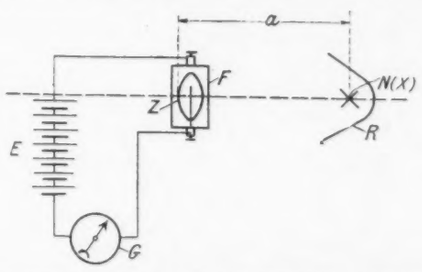


FIG. 1—EXPERIMENTAL PHOTOMETRICAL ARRANGEMENT

Illumination Calculations.—W. C. CLINTON.—An abstract of a paper read before the (British) Illuminating Engineering Society giving a comparison between results actually attained in artificial lighting installations and the predetermination from known data of the types of illuminants used.—London *Electrician*, April 24, 1914.

Electric Train Lighting.—JACOB.—A paper read before the German Illuminating Engineering Society on systems of electric train lighting. The author distinguishes pure storage-battery systems and systems using both a storage battery and a generator. The author briefly describes the principal features of four typical systems.—*Elek. Zeit.*, April 30, 1914.

Generation, Transmission and Distribution

Traveling Waves.—W. O. SCHUMANN.—A mathematical article on the deformation of waves traveling along conductors and especially the change to which the steep front of a traveling wave is subjected when it meets a resistance, inductance or capacity in the line.—*Elek. u. Masch.* (Vienna), April 26 and May 3, 1914.

Electric Winding Machines.—W. PHILLIPPI.—The conclusion of his paper on the present status of the electric winding machine. The author gives a comparison of the principal systems of electric winding and then compares steam driving with electric driving.—*Elek. Zeit.*, April 30, 1914.

Traction

High-Tension Direct-Current Traction.—P. AMSLER.—The motor-generator system for lighting low-voltage lamps on trains from the high-tension direct-current trolley supply, recently described in the Digest, may also be used for driving the railway motors. When the rating of an electric locomotive is as high as 2500 kw, it

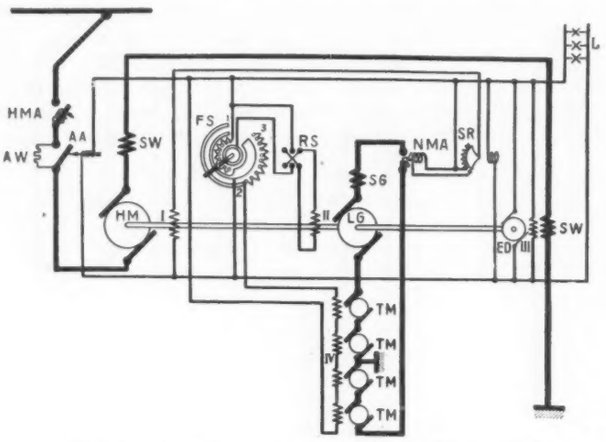


FIG. 2—DIAGRAM FOR WARD LEONARD SYSTEM

is necessary to raise the voltage on the trolley wire to 5000, but the design of 5000-volt traction motors would meet with considerable difficulties. The author, therefore, proposes to use the Ward Leonard motor-generator system, the arrangement being shown in Fig. 2. *HM* is the 5000-volt motor of the Ward Leonard system; *LG* is the Leonard generator, and *ED* is the small constant-voltage machine which feeds the excitation winding *I* of the high-tension motor *HM* with low-tension current. *H M A* and *N M A* are circuit-breakers, *A A* is an automatic starter, *A W* a starting resistor, *FS* controller, *RS* reversing switch, *TM* traction motors, *SR* rapid regulator, *I, II, III* excitation windings, and *L* lamps. Data are given on the electric equipment of a motor-car and locomotive with this system together with figures of weight, etc.—*Elek. Zeit*, April 30, 1914.

Railless Traction.—T. S. GRIBBLE.—A paper read before the (British) Institution of Civil Engineers on comparative economics of tramways and railless electric traction. He submitted evidence that for urban and suburban transportation track-laying has been carried far enough, and in many cases too far, maintaining that wherever overhead wires can be employed railless electric traction affords the best means of extending the tramways. The development of the railways brought about over-crystallization of the population, necessitating the adoption of means for decentralization, such as electric traction, without the heavy burden of permanent way. At the same time this would enable a supply of electricity to be given to sections of the population which at present lack that advantage. The author's final comparisons are shown in Fig. 3. He finds: (1) That with a traffic density represented by a two-and-one-half minute service the cost of working is still in favor of railless electric traction, although only to the extent of about 7 per cent. The cost of construction is, however, about 44 per cent less. (2) That the saving increases inversely with the traffic density, so that with a time interval of thirty minutes the cost of operation is about 36 per cent less and that of construction about 70 per cent less. The opinion that the economy of the "trolley-bus" ceases at a service frequency of about ten minutes is, in the author's opinion, quite unfounded. The tramway cannot serve the public as comprehensively as the "trolley bus." In order to serve the city best, the aim should be to reach the farthest suburb, and to supply the greater frequency of service in the center of the city by means of overlapping services radiating to the suburbs. The curves in the diagram are

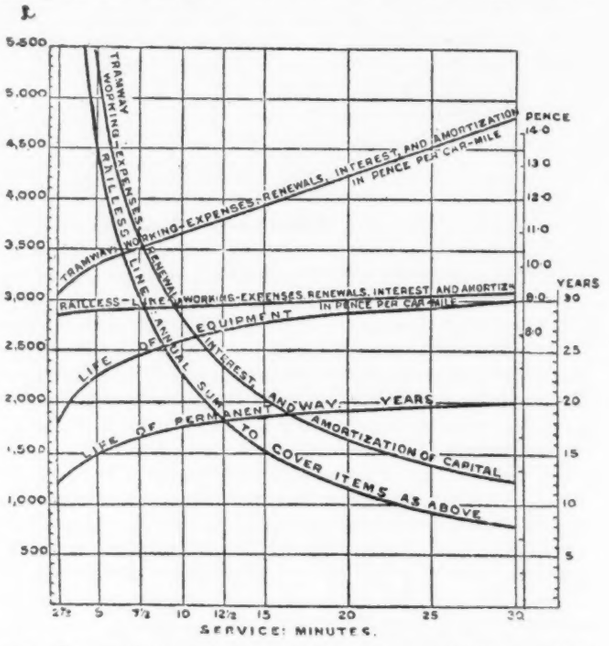


FIG. 3—CURVES SHOWING COMPARISON BETWEEN TRAMWAYS AND RAILLESS TRACTION

based upon the following assumptions: Length of route, 1 mile; length of traffic day, fourteen hours; scheduled speed, 7½ miles per hour; number of cars in service, car-mileage per day ÷ 105; number of cars in stock, car-mileage per day ÷ 70; power-house equipment rating, 25 kw × number of cars in service. Cost of power house with plant, 500 lb. × number of cars in service; rolling stock, 750 lb. × number of cars in stock; land and car-sheds, 200 lb. × number of cars in stock; cost of electrical equipment, from £1,000 to £3,000 and of track from £5,000 to £12,000 per mile of route, depending upon the traffic density.—London *Elec. Rev.*, May 1, 1914.

Installations, Systems and Appliances

Shanghai.—An article giving statistical data on the great progress which has been made during the last twelve months by the central station at Shanghai. There has been an increase of nearly 2500 hp in motors during the past year, the total aggregate horse-power now connected being over 5300. In addition to this very useful load, a bulk supply is given to two districts which amounts in the aggregate to nearly 6000 hp. Compared with December, 1912, when there were 6870 connections, the total number of consumers is now nearly 11,000. The load-factor has been improved from 23.5 to 30.8 per cent, and the minimum total load observed recently was over 8000 kw. At present over

600 radiators are connected, representing a load of just over 1000 kw. These figures show that the average input per radiator is in the neighborhood of 2 kw. The kilowatt-hours sold or accounted for were nearly 22,000,000, as compared with about 12,000,000 during the previous twelve months. The station introduces electrical vehicles and will add two 5000-kw turbo-alternators to its present plant.—London *Electrician*, May 1, 1914.

Wires, Wiring and Conduits

Calculation of Networks.—KARL FUCHS.—When the problem is to be solved to calculate the voltage drops in the different branches of a network with many branches, it is necessary to solve n linear equations with n unknown quantities. The author shows how the solution of these equations can be facilitated.—*Elek. u. Masch.* (Vienna), April 26, 1914.

Calculation of Alternating-Current Lines.—H. B. DWIGHT.—The determination of the requisite size of conductor for transmitting a certain amount of electric energy requires considerable calculation and reference to tables of transmission line constants. The author gives a chart for the regulation of alternating-current transmission lines which permits a great saving in calculations. The application of the chart is explained.—London *Electrician*, May 1, 1914.

Switches.—A set of rules for the construction and testing of switches, fuses, regulating resistors and starting resistors for voltages up to 750. This set of rules will be in force beginning July 1, 1915.—*Elek. Zeit.*, April 30, 1914.

Fittings.—A set of rules of the German Association of Electrical Engineers on the construction and testing of fittings, fuses, etc. These rules will be in force beginning July 1, 1915.—*Elek. Zeit.*, April 30, 1914.

Regulations for Mines.—In an appendix to the regulations of the German Association of Electrical Engineers on electric installations wiring rules are given for mines; also a set of symbols to be used in wiring drawings.—*Elek. Zeit.*, April 30, 1914.

Electrophysics and Magnetism

Gas in Vacuum Tubes.—GEORGE WINCHESTER.—An account of an investigation of the continued appearance of gas in vacuum tubes. Chemically pure electrodes give off gases in different proportions; for example, of two cathodes having the same weight one may be rich in helium and the other give off comparatively little, or one may give off more hydrogen than the other. Thus, apparently no relation exists between the size of the cathode and the amounts of gases which may be thrown off in a high vacuum when large potentials are applied to the electrodes by means of an induction coil. The explanation of this fact may depend upon the manner in which the gases are occluded in the metal. It seems probable that they are not a part of the metallic molecule in the same sense that the alpha particle is a part of the molecule of radium. Suppose, for instance, that the gaseous atom is simply held in contact with the aluminum atom or molecule by some force of adhesion, and that it is freed by repulsion on account of the very large number of negative electrons applied to the cathode. Then, if one cathode should disintegrate more thoroughly than the other before it was consumed, it would give off the greater amount of gas. The presence or absence of hydrocarbons within the experiment tube has no influence upon the amounts or kinds of gases evolved. So far as the author's experiments have gone there has been no instance when hydrogen could not be obtained if any metal of the cathode remained, with one exception. The fact that helium and neon may be entirely eliminated from the tube shows that they are not disintegration products; if they were, one should be able to generate them as long as he applied high potentials to the electrodes. But the case of hydrogen is different. There is the possibility of its being a disintegration product of the metal in somewhat the same manner as the alpha particle is disintegrated from radium. But while radium disintegrates spontaneously, the hydrogen requires the assistance of a large electric force before it is able to leave the metal.—*Phys. Review*, April, 1914.

Effect of Magnetization on the Opacity of Iron to Roentgen Rays.—A. H. FORMAN.—In a general way it would seem natural to expect that a change in the molecular arrangement of iron by magnetization, which produces the phenomenon of magneto-striction, should to some extent also effect the opacity of the iron to Roentgen rays. But the results of the author's experiments are negative since they appear to show that no effect is attributable to the magnetization of the iron, with the magnetization in a plane perpendicular to the Roentgen rays and either parallel or perpendicular to the axis of the X-ray tube.—*Phys. Review*, April, 1914.

Electrochemistry and Batteries

Copper Leaching and Electrolytic Precipitation in Chile.—E. A. CAPPELEN SMITH.—His American Electrochemical Society paper in full, with illustrations, on the development of copper leaching and electrolytic precipitation at Chuquicamata, Chile. The ore body is in excess of 200,000,000 tons. The author describes the process which has been developed in an extended experimental investigation at Perth Amboy. It comprises leaching of the ore with a sulphuric-acid solution, elimination of the chlorine from the solution by means of shot copper, and finally electrolyzing the solution, using insoluble anodes of fused magnetite and precipitating copper on ordinary copper cathode starting sheets. The first unit of the plant now in course of erection in Chile has been designed to treat about 10,000 tons of ore per day. The electrolytic refinery will have an output of about 335,000 lb. of copper per day. The generating equipment will consist of a primary station at the coast, using oil-fired boilers driving four steam turbines connected to four 10,000-kw alternating-current generators. The energy will be transmitted 85 miles at 100,000 volts to a substation located at the mill site. The substation for the electrolytic refinery will consist of seven motor-generator sets, each of 2500-kw rating.—*Met. and Chem. Eng'ing*, May, 1914.

Units, Measurements and Instruments

Magnetic Tests for Sheet Iron.—A set of the new rules of the German Association of Electrical Engineers for the testing of sheet iron. These rules will be in force beginning July 1, 1914. For measuring the iron losses and the magnetization a magnetic circuit is to be used which contains only iron of the quality to be tested. The sample should weigh 10 kg (22 lb.) and should be taken from at least four different sheets. The iron is to be tested at 20 deg. C. The iron loss is to be given in watts per kilogram for a pure sine wave of the emf for the maximum values of the magnetic induction = 10,000 and 15,000 c.g.s. units. These figures are called loss figure (Verlustziffer) and are written V_{10} and V_{15} respectively. The "aging coefficient" is the change of the loss figure in percentages for $B = 10{,}000$ after 600 hours of heating to 100 deg. C. The magnetization is indicated by the values of the induction B at two different field intensities in the iron. These two values are chosen from 25, 50, 100 and 300 amp windings per centimeter. These values are indicated by B_{25}, B_{50}, B_{100} and B_{300}. Figures of specific weight of iron are given; 0.35. 0.5 and 1.0 mm. are standard thicknesses of sheets. The iron strips used for the test should be 500 mm long and 30 mm wide and should be cut one-half parallel to

the direction of rolling and the other half perpendicular to the direction of rolling. The Epstein apparatus is used for the tests.—*Elek. Zeit.*, April 30, 1914.

Telegraphy, Telephony and Signals

Variation of Speech by Microphones.—A. BLONDEL AND S. POLAK.—The authors give an account of an oscillographic study of microphones with a view to bringing to the notice of experts the different records obtained of the same sound by different types of microphone. The arrangement of the experiments is shown in Fig. 4. A triple bifilar Blondel oscillograph was employed, the bifilar suspensions, 2 and 3, being used to register the currents in the microphones M_1 and M_2; the third bifilar was hung on an electric tuning fork, giving 200 vibrations per second and permitting the frequency of the waves to be registered. For sounds the authors employed the human singing of vowels, a bell, a special siren, a clock, etc. The microphones were suspended by long wires in front of the source of sound, in identical positions, and the identity of the records was verified by interchanging the microphones and connections. The two bifilars were connected in series with the same microphones, and four oscillograms were taken as follows: One when the current was nil; one with the circuit closed and the current equal to 1/100 amp through the two bifilars

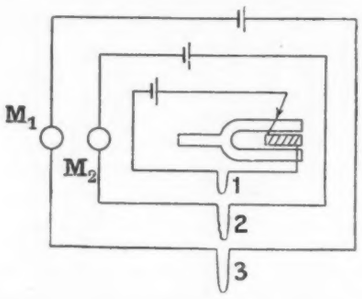


FIG. 4—ARRANGEMENT FOR MICROPHONE EXPERIMENTS

and the microphone; one when the vowel *a* was sung before the microphone; one with the vowel *i*. The oscillographs obtained show clearly the effect of the type of microphone. All the oscillograms tend to show that the microphones preserve well the fundamental wave of the note, but alter the higher Helmholtz harmonics characteristic of the vowel. The deformation of the higher harmonics is a fault inherent in all the usual microphones. To explain the reason for this it is natural to attribute it to the resonance of the apparatus and to find out the natural frequency of the microphones. The authors conclude that this investigation shows at least that it is necessary to proceed with caution if one wishes to draw, from theory or practice, conclusions from oscillographic studies of microphones. The microphones can introduce their own oscillations, of a frequency independent of that of the sound of the human voice, every time the membranes or the granules are not sufficiently damped; likewise an excessive damping can suppress certain harmonics. One sees from this point of view the great difference between microphones of similar appearance. Microphones with granules give very many superfluous vibrations. It seems that the better method of recognizing with precision the composition of vowels in telephonic transmission would be the synthetic method, consisting of superimposing a principal emf on the harmonic terms produced by other small alternators, as has been done, for example, by Cahill for the reproduction of the sounds of musical instruments.—London *Electrician*, April 24, 1914.

Wireless-Telegraph Recorder.—ALFRED GRADENWITZ.—An illustrated description of the Tauligne wireless-telegraph recorder, which consists of a special electrolytic detector allowing the depth of immersion of a platinum wire electrode to be regulated, a polarized magnetic relay, and a variable-speed Morse recorder. These parts are supplemented by a tuning coil and various accessories.—London *Elec. Review*, April 10, 1914.

Book Review

METAL STATISTICS 1914. Issued by the *American Metal Market and Daily Iron and Steel Report.* New York: The American Metal Market Company. 288 pages. Price, 50 cents.

The additional statistics which the editors of this handbook have included in the seventh annual edition serve to make the 1914 issue a wonderfully handy and complete record of the 1913 metal situation. All the essential statistics of production, consumption, exports, prices and duties for iron, steel, copper and the other staple metals seem to be adequately covered. It was not possible to include final and certified figures for 1913 in all cases; but estimated values are included for the more important items, and these seem to bear out the general conclusions which had been already formed of metal production during the latter half of last year. The 1913 figures for total United States production of ore, pig-iron and steel all go to fresh high levels. Total iron and steel exports for the year are slightly less in tonnage than in 1912, although they have a value of $302,000,000 as against $289,000,000 in the preceding year. The increase of pig-iron production was due to new high records in the earlier part of the year, the figures for the latter six months being over 1,000,000 tons (or 7.5 per cent) less than in the preceding year. Estimated figures for the world's pig-iron production show the United States supplying over 40 per cent of the total. Statistics for the United States Steel Corporation show total earnings of $140,000,000 for 1913, against $108,000,000 for 1912; but figures for unfilled orders for the various months of 1913 indicate a very marked decrease in activity toward the end of the year, October, November and December showing a progressive decline of 40, 44 and 46 per cent as compared with the same months in 1912. The copper production for the entire country showed a decrease of 1.5 per cent over 1912, the total being a trifle under 1,250,000,000 tons. For the first five months 1913 exceeded 1912 by a substantial margin; June and July came out at about the same for the two years, while for the last five months (with the exception of November, which was about even) 1913 production fell considerably below that of 1912. This difference is explained by the tables showing domestic and export consumption, a material falling-off in the home demand occurring in the latter part of the year, with exports running substantially higher than 1912 right through the year. The report of the Copper Producers' Association shows that the deliveries into domestic consumption in December, 1913, were only 37 per cent of their tonnage for December, 1912, while the domestic consumption for the year was 767,000,000 tons against 819,000,000 tons in 1912. The status of electrical manufactures in 1913 (which are responsible for, say, one-half the domestic consumption) will about reflect the conclusion that may be drawn from that ratio. The remaining sections of the handbook provide similar data on tin, lead, spelter, aluminum, antimony and silver, while a good deal of general information on these and other metals is given under a caption of "miscellaneous."

New Apparatus and Appliances

An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

Electric Fluting Irons

The fluting attachment illustrated in Fig. 1 is for use with an electric iron. The rocker is so constructed that its corrugations draw the fabric into the grooves of the base and press it in such a manner, it is claimed, that there is no danger of tearing. A self-heated elec-

FIG. 1—FLUTING ATTACHMENT

FIG. 2—ELECTRIC FLUTING IRON

tric fluting iron is shown in Fig. 2. The heating unit is contained in the base and is designed to provide heat enough for pressing. This iron is equipped with a quickly detachable connector which permits of rapid removal of the cord from the iron and also allows the user to regulate the heat to the work in hand. Both these devices are being placed on the market by the Simplex Electric Heating Company, Cambridge, Mass.

Pull-Switch Rosettes

A number of different types of pull-switch rosettes, embodying the so-called "Fluto" interchangeable arrangement, are being placed on the market by Pass & Seymour, Inc., Solvay, N. Y. These rosettes are equipped with a short chain to which is added 10 ft. of black linen cord with a black acorn attached to the

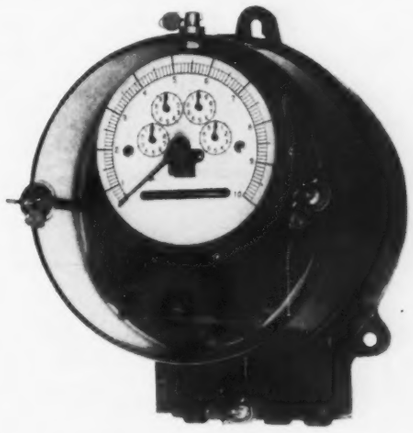
PULL-CHAIN ROSETTES WITH LINEN CORD ATTACHED

end. By means of the cord, eyelets or pulleys can be used so that the switch may be operated at a distance. Various kinds of bases are used for these rosettes, the type of base depending on whether the rosettes are to be used on cleat work, outlet-box work, ordinary concealed wall work, or for taplets, conduit boxes, etc. Two of these rosettes are shown herewith.

Watt-Hour Demand Meter

A meter designed to record both the kilowatt-hours and the maximum kilowatt demand without the use of a clock mechanism is shown herewith. The maximum demand is indicated by a pointer sweeping over a 4-in. dial and the number of watt-hours consumed is recorded on a four-dial counter.

The meter is a combination of an induction watt-hour meter, an induction wattmeter and an escapement form of time element. The instrument has an ordinary watt-hour meter movement, including electromagnet, permanent magnet and aluminum disk. In addition, it has an auxiliary disk sector supported on a jewel-and-ball bearing so that it can move in the air-gap of the electromagnet in such a way that it does not interfere with the accuracy of the main disk, which always rotates at a speed proportional to the load. The rotation of the auxiliary disk is restrained by a spiral spring, making its final deflection proportional to the watts



WATT-HOUR DEMAND METER

taken. The auxiliary disk with its spring and pointer constitute an indicating wattmeter.

The shaft of the auxiliary disk is geared to an escapement wheel, and the claw restricting this wheel is oscillated by an eccentric on the main shaft. The auxiliary disk, therefore, advances step by step at a speed determined by the speed of the main watt-hour meter disk, that is, at a speed proportional to the load. It continues to advance until the spring tension balances the torque produced in the auxiliary disk. The demand mechanism is then in equilibrium and the pointer indicates the watts. The auxiliary disk drives the demand pointer.

The maximum demand pointer can be reset instantly by pressing a sealed button on top of the cover. This raises the pawl that holds the pointer in its maximum position, and a light spring returns the pointer to zero or to the position of the auxiliary disk.

This watt-hour demand meter is being made by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

China Domes

A dome made of china and designed by manufacturers of art ware and decorative dinner sets for use with electric lamps is now being placed on the market. This dome, which is illustrated herewith, is made of opaque china, a high-grade clay being used in its manufacture. The body of the dome is snowy-white, and the surface, both interior and exterior, is provided with a velvety glaze. The design in the illustration is known as a Byzantine motif and consists of hand-painted filigree-work of coin gold encircling the dome and an artistic centerpiece at the base. The outside rim is finished with a wide band of gold. Domes of this type can be embellished with a variety of decorative colors, and as the colors are burned in the china, the decorations do not deteriorate or become tarnished. Both 16-in. domes with a depth of 5.5 in. and a height from ceiling to base of dome of 38 in. and 12-in. domes with a depth of 8 in. and a height from ceiling to base of dome of 28.5 in. are being made. Two 60-watt lamps, two 150-watt lamps, one 250-watt lamp or one 400-watt lamp can be used with this dome.

OPAQUE-CHINA DOME

The dome described in the foregoing paragraph is being manufactured at the works of the H. R. Wyllie China Company, Huntington, W. Va.

Electrical Features of the Forest Products Show at Chicago

Opening at the Coliseum in Chicago on April 30 and continuing through May 9, the Forest Products Exposition, showing wood in all forms, from sawdust to finished bungalows, contained several features of electrical interest. One of the attractive exhibits, shown in an accompanying illustration, was that of the Northern White Cedar Association, formerly the Northwestern Cedarmen's Association. Straight and sturdy 25-ft. and 30-ft. poles of standard sizes were erected at the corners and in the center of the exhibit. Cross-arms carrying insulators and wire lent a realistic atmosphere to the display. Even the guy wires, of No. 6 steel, were served about the tops of the poles, as though a practical lineman had recently completed his work. The exhibit represented the twenty-eight members of the Northern White Cedar Association, of which Mr. N. E. Boucher, Minneapolis, Minn., is secretary.

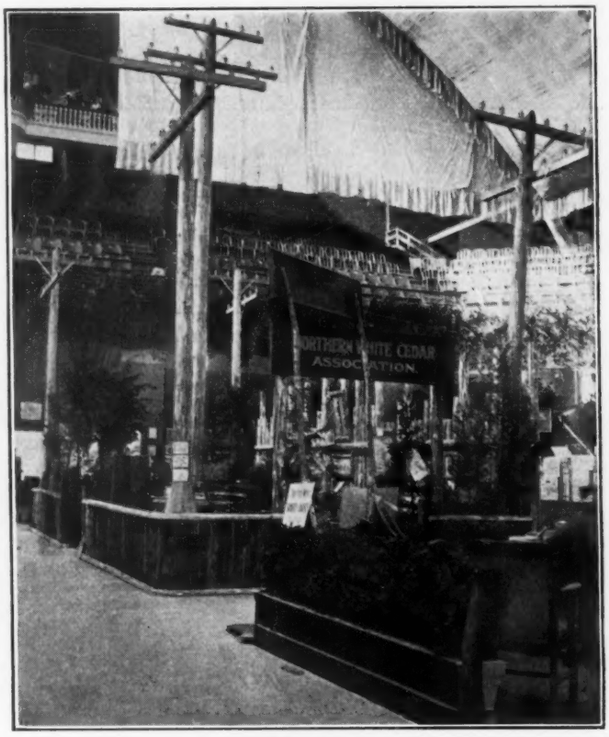


FIG. 1—WHITE-CEDAR POLES AT THE FOREST PRODUCTS SHOW, CHICAGO

As a portion of the exhibit of the cypress producers a large electric sign (Fig. 2) presented a spectacular appearance. The sign, suspended aloft, consisted of a real cypress log, which had been quartered, hollowed out and fastened together again so that it had the appearance of a solid piece of timber. In the side of the log the legend "Cypress—the Wood Eternal," illuminated by electric lamps from the interior, stood out in bold relief and caused the spectator to wonder at the ingenuity with which the light sources were hidden. Closer observation, however, showed the electric circuit coming over the butt of the log and entering through the letter "L."

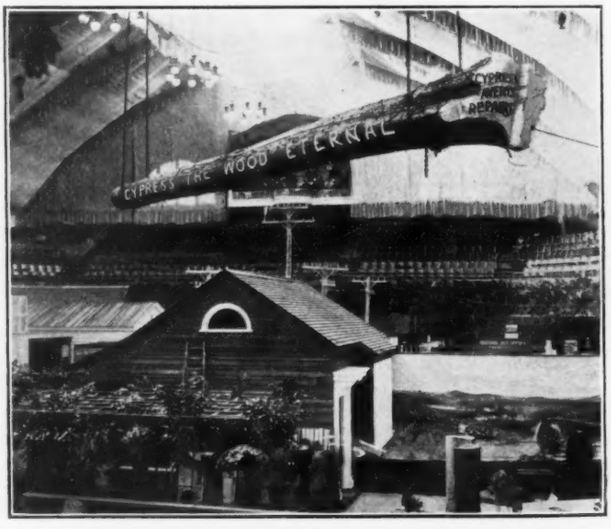


FIG. 2—CYPRESS-LOG DISPLAY AT THE FOREST PRODUCTS SHOW, CHICAGO

Indirect Lighting for Boys' High School, New Orleans

Indirect lighting is used throughout in the illumination of the Boys' High School, New Orleans, La., and in the design of this school building the lighting equipment was considered an integral part of the complete building.

FIG. 1—LIGHTING IN CHEMISTRY LABORATORY

In Fig. 1 is shown the method of illuminating the chemistry laboratory. The room is 25 ft. wide by 41 ft. long and the ceiling is 13 ft. high. Each of the three fixtures used is provided with five 100-watt clear-bulb tungsten lamps suspended 36 in. below the ceiling. The value of watts taken per square foot of floor area is 1.46, and the intensity is 3.4 ft.-candles.

The banking room shown in Fig. 3 is a large class or study room, 75 ft. long by 25 ft. wide, with the ceiling 13 ft. above the floor. In this room five fixtures are each equipped with five 100-watt clear-bulb tungsten lamps, suspended 36 in. from the ceiling. The

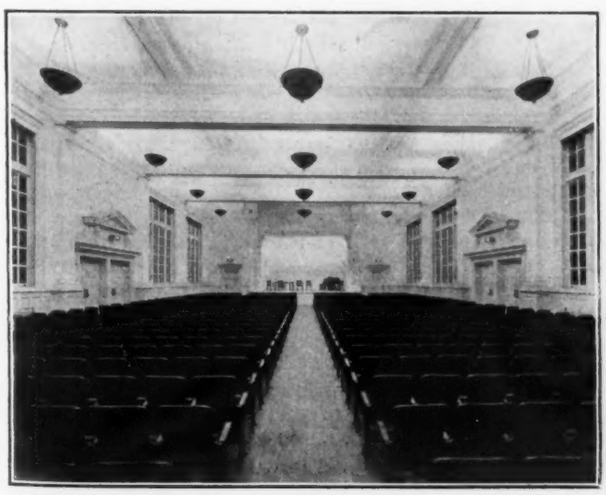


FIG. 2—LIGHTING IN AUDITORIUM

number of watts per square foot of floor area is 1.40, and the intensity is 3.3 ft.-candles on the working plane.

In Fig. 2 is shown the arrangement of the fixtures in the auditorium. This hall is 52 ft. by 73 ft. in size and the height of the ceiling is 26 ft. There are fifteen fixtures arranged in three rows of five units to the row. Each of the center fixtures carries seven 100-watt clear-bulb tungsten lamps and each of those in the outside rows five 60-watt clear-bulb tungsten lamps. The bowls are hung 62 in. from the ceiling. The total area of this auditorium is 3800 sq. ft. and the number of watts used per square foot, therefore, is 1.71. The units are wired so that each set of lamps can be turned on separately. The average horizontal illumination in this auditorium

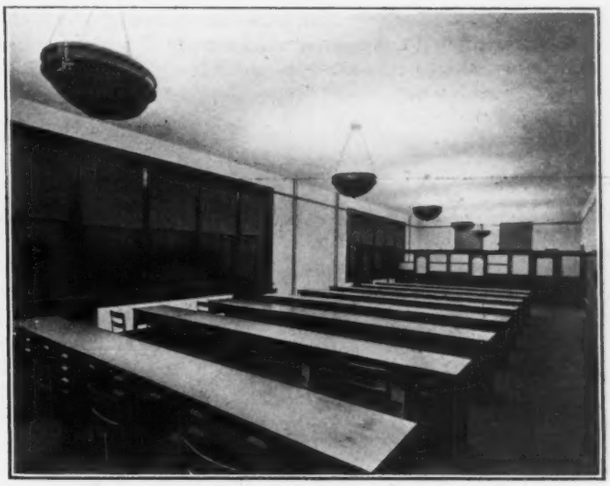


FIG. 3—LIGHTING IN BANKING ROOM

on a plane 36 in. above the floor, when all the equipment is in use, is approximately 4.3 ft.-candles.

A typical classroom is shown in Fig. 4, the size being 25 ft. by 35 ft. and the height of the ceiling 13 ft. Two fixtures are used, each being equipped with five 100-watt clear-bulb tungsten lamps. The bowls are suspended 42 in. below the ceiling. The total number of watts taken is 1.14 per square foot, giving an intensity at the desk tops of 2.6 ft.-candles.

The fixtures used in this building were supplied by the National X-Ray Reflector Company. They are made of a tough fibrous material called "compone." The reflectors are of one-piece crystal glass plated with silver, which is protected with a green enamel. The designs for the building were prepared by Mr. E. A. Christy, city architect of New Orleans. The attention given in them to the important matter of lighting might well be emulated by all concerned in the erection of school buildings anywhere.

FIG. 4—LIGHTING IN TYPICAL CLASSROOM

Jobber, Dealer and Contractor

Central-Station Co-operation with the Contractors in Texas

The Texas Power & Light Company, which furnishes electric service in thirty-three communities in the Lone Star State, believes thoroughly in co-operating with the contractors and dealers in the localities served by its lines, and to this end the company has made it a rule to do no wiring and to sell no appliances, lamps or supplies, referring its customers in each instance to local dealers and contractors.

Carrying out the same idea of co-operation, the company joined forces with the contractors and dealers of Waco in arranging a really co-operative display booth at the time of the last Waco Cotton Palace. The power company rented the large space shown and also furnished free the services of an attendant and all the electricity and gas required by the apparatus on display.

CO-OPERATIVE DISPLAY OF THE CENTRAL STATION AND THE ELECTRICAL CONTRACTORS AT WACO, TEX.

On their part the contractors and the plumbers (the company supplies gas also in Waco) did all of the installation work for the booth, ran wires and pipes, and furnished from their stocks the appliances exhibited. All identifying marks were removed from the exhibits, and the only place where the dealers' names were shown was on a large painted signboard at the rear of the booth, which listed all those taking part in the exhibition.

Bookkeeping for Electrical Contractors

Bookkeeping, said Mr. W. J. Ball, Moline, Ill., before the recent convention of the Iowa Electrical Contractors' Association at Cedar Rapids, is the art of keeping a systematic and regular record of business and mercantile transactions so that the condition of your business may be known at any time. There are many ways of keeping books, but the detailed extent to which the bookkeeping department of a contractor's business should be carried must necessarily depend upon the amount of business he does, the size of his stock and whether his work is all of one kind. If he is a successful contractor and wishes to branch out a little into handling electric automobile work, motor repairing and fixtures, he should arrange his books so as to know whether each addition to his business is helping the paying end or whether the paying end is carrying along a load that he would better not have added to his business.

Questions to Be Answered

In other words, how much contracting does one do and how much does it cost one to do it? How much fixture business does one do? How much rent does the space occupied by his fixture department cost? How much does it cost to assemble and hang fixtures? These things must be considered as well as others before profit can be added to the job. The books must tell the story. All carry fire insurance and pay money out on profits for this protection, but if one's store and contents burn up to-night, would it be possible to show the insurance adjuster to-morrow morning what the loss is? If books are kept properly, this can be done without difficulty.

Contractors borrow money now and then, if they can, but can they take a nicely prepared financial statement of their business for last year to their banker and convince him from the showing thereon that he ought to be glad to loan them the money? Where books are kept properly and the business warrants the loan there is no trouble in obtaining it ordinarily. Bills should be made out, not with a scratchy old pen, but with a typewriter, because it is much easier to collect a nicely written bill than one that is not. Time should not be spent in collecting for work done, but customers should be educated to bring the money to the office promptly when the bills fall due.

What Books Should Show

If a building is owned, rented or leased, the books should show the value of the improvements installed and a proper amount should be set aside for depreciation. If an automobile is used in the business, its present value should be shown by the books as well as what it costs to keep it running and in repair. A contractor should be able to tell at a glance what his purchases and sales of merchandise are at any time. A record should be kept of labor costs, rent, taxes, insurance, telephone, hauling, light, etc.

Monthly Record as a Spur

A fine feature is a tabulated record of gross business for each month. The Tri-City Electric Company has such a record since the business was started about fifteen years ago. It is looked at often and is the greatest incentive known to make each month better than the corresponding month of the year before. Customers should be made to understand that a desire for business after the price is agreed on is measured only by their promptness in paying for the work. It is foolish to tickle one's self with a lot of old accounts that are outlawed and that no one can collect, because one loses the respect of his customers and has thereby a good start on the road to financial ruin. Customers should understand that credit is the best asset a business can have and that it can only be maintained through their co-operation.

System in All Things

A time-record sheet of workmen should be kept, so that one can find next year whether John Jones worked on a certain day and where. Such a record might be useful in court in case of a lawsuit under the compensation act or by the contractor against a customer. The dates of deliveries and quantities of material sent to jobs should be a matter of record at all times. Catalogs should be filed and indexed because the ability to quote a customer a price without keeping him waiting oftentimes secures his order. If by filing plans one can refer to them easily and can tell a customer the layout of a job done a year ago, it may convince him that attention to details of this kind entitles one to any further business the customer may have to offer.

Industrial and Financial News

Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

Biggest Month for Terry Turbines.—In spite of the hard-times reports, the month just passed has been the biggest one in the history of the Terry Steam Turbine Company, Hartford, Conn., both in point of orders and in output.

Electric Brewery Trucks for Milwaukee.—Purchasing four electric trucks from the General Vehicle Company, Inc., the Val Blatz Brewing Company, Milwaukee, will become, perhaps, the first user of the electric truck in the brewery trade in that city. Each of these trucks is of 5 tons capacity and is equipped with sixty cells of type A-12 Edison battery.

Clay-Conduit Business Fair.—The H. B. Camp Company reports its business as being fair. No large installations are being made, but many small orders for additions to existing conduit systems are continually being received. The amount of work being done is not so great as was expected a few months ago. One of the causes suggested for this is the late spring and general inclement weather.

Orders for Lighting Standards for New York City.—The J. L. Mott Iron Works, 118 Fifth Avenue, New York, have received an order for 300 single-unit tungsten-lamp standards from the city of New York. These will be installed in Park Avenue. This company is managing to hold its own in regard to the number of standards sold, and prospects for an increase in the near future appear to be bright.

Reporting Valuation of Properties.—Forstall & Robison, engineers, 84 William Street, New York, state that they are reporting the valuation of several large properties. They deal chiefly with gas companies and incidentally with electric companies when the latter are connected with the former. Mr. Forstall has just returned from a trip to the Middle West, and he reports conditions as he saw them as rather quiet in that section of the country.

New Building for Electrical Manufacturer.—Ground has been broken for the construction of a new factory building to take care of the rapidly growing output of the Robbins & Myers Company, Springfield, Ohio. This building will be immediately south of and adjoining the new shops, which were completed a little less than a year ago. It will be of reinforced concrete, the same type of construction used in the other buildings. The new building will be four stories high, and it will cover a ground area 60 ft. by 265 ft.

Advertising Helps for Selling Electrically Driven Irrigation Apparatus.—In order to increase and facilitate the sales of apparatus for use in irrigation, the Western Electric Company has prepared a number of advertisements, electrotypes of which are supplied to dealers handling this kind of apparatus, for insertion in various newspapers. This is in line with the Western Electric Company's policy in selling other types of apparatus to do more for its customer than supplying the material and to assist him in disposing of the article itself.

Business in Carbons for Arc Lamps Slackening.—A representative of Mr. Hugo Reisinger, 11 Broadway, New York, importer of carbons for arc lamps and carbon brushes, declares that the business in carbons for arc lamps is rather dull. This industry seems to be affected to quite an extent by the new nitrogen-filled lamp. The use of carbons for moving-picture lamps is quite extensive, and the sales in this branch of the business are large, covering orders not only from all parts of this country, but from the South American republics, Mexico and other foreign countries as well. The business in carbon brushes is said to be fair.

European Firm Installing Large Selling Organization in the United States.—The Koerting & Mathiesen Company, of Leipsic, Germany, is preparing to increase its selling organization in the United States, and in addition to the flaming-arc lamps and arc-lamp supplies which it has been selling, it will also have for sale in this country six additional types of arc lamps, watt-hour meters, searchlamps, dynamos and motors. The arc lamps will be for both indoor and outdoor service. The New York branch recently moved into larger quarters at 49 East Twenty-first Street. Later on warehouses will be erected in this country. A complete stock will be on hand about July 1. For some time all shipments will be made through New York; later, however, a branch will be opened in San Francisco, and then shipments will also be made via the Panama Canal through that port.

Prismatic Reflectors for Government Service.—A large number of prismatic reflectors are being supplied to the government for various buildings and warships by the Holophane works of the General Electric Company. The reflectors on the warships require a special hanger, and this company has gone to considerable trouble and expense to develop a satisfactory hanger and reflector for warship usage. Since the advent of the high-efficiency tungsten lamps this company has been busy supplying reflectors for this type of unit. Recently orders were received for 200 Holophane reflectors for use with 750-watt and 1000-watt nitrogen-filled tungsten lamps in the amusement parks of Coney Island, N. Y.

Activity in Construction Work.—Westinghouse, Church, Kerr & Company are doing considerable construction work in the East. Some of this work includes the construction of eight shop and office buildings for the Central Railroad of New Jersey in Jersey City; the revamping of the Pearl Street substation at Hartford for the Hartford Electric Light Company, Hartford, Conn., with a new layout for all the alternating-current switching and an installation for this same company of an outdoor substation and regulator equipment in the Unionville Electric Lighting Company's old plant; the construction of a gas-producer plant and coal-handling apparatus at the Port Alleghany (Pa.) plant of the Mississippi Glass Company; miscellaneous construction work for the Peter Cooper Glue Factory, Brooklyn, N. Y.; and the installation of pipe trenches and tunnels and increasing the capacity of the coal-handling plant of the Winchester Repeating Arms Company, New Haven, Conn.

Manufacturers Bid on Sanitary District Generating Equipment.—With but three manufacturers bidding upon the 4000-kw turbo-generator, condenser and accessory equipment to be installed in the Thirty-ninth Street pumping station of the Sanitary District, Chicago, prices range from $53,738 to $56,111. The General Electric Company placed four bids, specifying in each case a different make of condenser. One bid was placed by the Westinghouse Machine Company and two by the Allis-Chalmers Manufacturing Company. Different guarantees account for difference in the two Allis-Chalmers bids. In the General Electric Company's bids the generator specified is operated at 2300 volts, while the other manufacturers specified a 12,000-volt generator. The following table gives the amounts of the bids as they were opened on May 14:

Name of Company	Motor-Driven Accessories	Turbine-Driven Accessories	Condenser
General Electric Co.	$55,100	$56,111	Wheeler Condensing & Engineering
General Electric Co.	53,724	54,146	Worthington
General Electric Co.	55,425	55,906	Wheeler Manufacturing
General Electric Co.	53,738	53,740	Alberger
Westinghouse Machine Co.	56,579	56,579	Westinghouse
Allis-Chalmers Manufacturing Co.	54,113	54,435	Wheeler Manufacturing
Allis-Chalmers Manufacturing Co.	55,397	55,718	Wheeler Manufacturing

Orders for Gas Engines.—Orders which have recently been received by the Bruce-Macbeth Company for its vertical, multi-cylinder gas engine include the following: One 40-hp two-cylinder natural-gas engine for Pietro Elardo, Fredonia, N. Y.; one 60-hp two-cylinder natural-gas engine for the Fairmont Gas Company, Underwood, W. Va.; one 150-hp four-cylinder natural-gas engine for the Willard Storage Battery Company, Cleveland, Ohio, making the seventh engine for this company; one 90-hp four-cylinder natural-gas engine for Ohio University, Athens, Ohio; one 70-hp two-cylinder natural-gas engine for the Wood & Spencer Engineering Company, Cleveland, Ohio; two 50-hp, two-cylinder producer-gas engines for the Alberta Financial Brokers, Ltd., Calgary, Alberta, Canada; two 60-hp two-cylinder producer-gas engines for the village of Warroad, Minn.; one 150-hp natural-gas engine for the village of Caldwell, Ohio; one 70-hp two-cylinder natural-gas engine for the city of Whitesboro, Tex.

Shiras Company Absorbs Chicago Fixture Company.—The Shiras-Chassaing Electric & Manufacturing Company, of 921 Locust Street, St. Louis, announces that it has purchased the plant of the Chicago Gas & Electric Fixture Manufacturing Company. The property of the latter company will be removed to St. Louis. On a four-acre tract in Wellston, St. Louis County, the Shiras-Chassaing company is building a structure 175 ft. long and 100 ft. wide for its general offices and factory. It is expected that about 300 men will be employed soon after June 1. The capital stock of the Shiras-Chassaing Company has been increased to $150,000. Mr. Oliver Shiras remains the president, Mr. Joseph Chassaing, formerly general manager of the Chicago concern, becoming vice-president and general manager of the Shiras-Chassaing Company. The display rooms at 921 Locust Street are being altered and improved. The Chicago Gas & Electric Fixture Manufacturing Company was a well-known concern of Chicago, its office being at 124 North Jefferson Street.

Nitrogen-Filled Series Tungsten-Lamp Bids Opened.—Opening the bids for compensators, with globes and fixtures complete, and nitrogen-filled series tungsten lamps complete, for street lighting, on May 14, officers of the Sanitary District, Chicago, found six companies offering proposals. On compensators and globes the companies' figures differed considerably, but terms as to prices and delivery on the nitrogen-filled lamps were identical in every case. The following table shows how the bids stood:

	Compensators and Globes		Lamps	
Name of Company	First 2000, Each	10,000, Each	First 2000, Each	10,000, Each
Line Material Company	$26.90	$24.90	$4.50	$3.655
Western Electric Company	15.90	15.40	4.50	3.655
General Electric Company	14.50	14.00	4.50	3.655
Westinghouse Lamp Company	10.20	10.05	4.50	3.655
Westinghouse Lamp Company	13.60	13.45	4.50	3.655
Peerless Light Company	....	....	4.50	3.655

NEW YORK METAL MARKET PRICES

Copper	May 12 Bid	May 12 Asked	May 19 Bid	May 19 Asked
Standard spot*	13.50	14.00	13.65	14.00
	Selling Prices		Selling Prices	
	£ s d		£ s d	
London, standard spot*	63 3 9		63 7 6	
Prime Lake	14.37½	to 14.50	14.37½	to 14.50
Electrolytic	14.00	to 14.10	14.10	to 14.20
Casting	13.90	to 14.00	13.95	to 14.05
Copper wire base	15.25	to	15.25	to .....
Lead	3.90		3.90	
Nickel	40.00	to 45.00	40.00	to 45.00
Sheet zinc, f.o.b. smelter	7.00		7.00	
Spelter, spot	5.15	to 5.25	5.15	to 5.25
Tin, spot	34.37½	to 34.62½	32.87½	to 33.12½
Aluminum:				
Prompt delivery	17.87½	to 18.12½	17.75	to 18.00
Future	17.75	to 18.00	17.75	to 18.00

*OLD METALS

Heavy copper and wire	12.87½	12.87½
Brass, heavy	8.62½	8.62½
Brass, light	7.50	7.50
Lead, heavy	3.90	3.90
Zinc, scrap	4.15	4.15

*COPPER EXPORTS

Total tons to May 5	22,578

*From daily transactions on the New York Metal Exchange.

Corporate and Financial

Western Power Company.—Mr. F. Lothrop Ames, Boston, has been elected president of the Western Power Company, and Mr. Irving Bonbright a member of the executive committee.

United Railways Investment Company Readjustment.—The following committee has been named to prepare a plan for readjustment of the finances of the United Railways Investment Company: Mason B. Starring, president of the company; Henry Almstedt, Louisville, Ky.; C. H. Bean, Philadelphia, Pa.; Henry J. Bowdoin, Baltimore, Md.; James D. Callery, Pittsburgh, Pa.; Frank R. Ford, Sidney March and F. S. Smithers, New York, N. Y., and Edwards Whitaker, St. Louis, Mo.

Washington Utilities Company Notes.—The Washington Utilities Company has sold $1,500,000 of one-year 5 per cent collateral trust notes dated May 1, 1914, to the Fidelity Trust Company of Baltimore. The notes are being offered for sale on a 6.25 per cent interest basis. They are secured by deposit of 27,500 shares of common stock of the Washington Railway & Electric Company. The issuing company agrees to limit the payment of dividends on its stock during the life of the notes to 2 per cent a year.

British Westinghouse Company Results.—The fourteenth annual report of the British Westinghouse Electric & Manufacturing Company, Ltd., covering the year ended Dec. 31, 1913, shows a gross profit of £223,103. The following deductions were made: Depreciation on works, machinery, plant, etc., £44,100; redemption of 6 per cent prior-lien debentures, £6,728; interest on 6 per cent prior-lien debentures, £13,282; interest on 4 per cent mortgage debenture stock, £49,654; expenses on surplus land and buildings, £2,856; total, £116,-610. Net profits for the year were £106,493. Of this amount £50,000 was appropriated for general reserve, £50,000 was paid as dividends of 5 per cent on preference shares, and £6,493 was carried to surplus. The report says that the scheme for the reduction of capital approved by the shareholders has been sanctioned by the court since the last annual general meeting and the accounts are based thereon. The directors report a continued improvement in the business and an increased volume of work. A balance of £66,899 to the credit of profit and loss account as of Dec. 31, 1912, was absorbed in the reduction of capital.

Northern Texas Utilities Company.—The Northern Texas Utilities Company, of Dallas, recently incorporated with a capital stock of $500,000, has acquired the electric-lighting plants at Royse City, Rockwall, Bowie, Garland, Henrietta and Clifton, all towns of 1000 to 3000 population, in the northern section of the State. The company also has franchises for furnishing electric service in the towns of Bellevue, Alvord and Sunset and will later extend its scheme of operations to ten or fifteen other towns in the same vicinity. Garland, Rockwall and Royse are to be tied together with a 13,000-volt or 22,000-volt transmission line, electric service for all three communities being generated in an enlarged plant at Rockwall. Similarly Bowie, Henrietta and other towns of a second group will be interconnected and supplied with energy over a transmission line. Clifton is situated at some distance from the other two groups and will be served from its individual plant. The total population of the communities in which the Northern Texas Utilities Company is to operate numbers 22,000. Among the advantages which it is hoped to secure through centralized generation in large plants is increased efficiency in the use of fuel, as the price of coal is quite high in the section where the company plans to furnish lighting and motor service. An aggressive campaign will be instituted to secure all available "power" business in the territories served. Mr. Hiram Grosman, of Hiram Grosman & Company, investment brokers, Dallas, is president of the North Texas Utilities Company, and Mr. W. C. Woodlief, formerly of Corsicana, is secretary, treasurer and electrical engineer. The directors of the company are Messrs. W. D. Austin, Rockwall, Tex.; C. H. Boedecker, Bowie, Tex.; J. P. Quirk, Minneapolis, Minn.; J. B. Round, New York, and J. J. Mueller, Chicago. The company is capitalized at $500,000, of which $200,000 is preferred stock and $300,000 is common stock.

Business Notes

The Koerting & Mathieson Company, of New York, has moved to new quarters. The address is now 49 East Twenty-first Street.

The Standard Paint Company, of 100 William Street, New York, announces that its New England office is now at 6 Beacon Street, Boston, Mass.

The Railway and Industrial Engineering Company has moved its offices and works to Greensburg, Pa. The office was formerly in Pittsburgh and the factory at Wilkinsburg, Pa.

Edison Storage Battery Supply Company.—Bertram Smith, formerly manager of the Chicago office of the United States Light & Heating Company, has become associated with the Edison Storage Battery Supply Company, of San Francisco, in the capacity of assistant manager.

The Swedish General Electric Company is the new name adopted by Messrs. Kilmer, Pullen & Burnham, Ltd., 1009 Kent Building, Toronto, Can. It was believed that it conveyed a better idea as to the business the company is conducting, that is, that of supplying Swedish generators, motors and other electrical apparatus, for which there is an increasing demand. Frank Pullen is president.

Rialto Engineering & Construction Company.—Fred E. Hummel and A. H. Braunagel have formed a corporation to be known as the Rialto Engineering & Construction Company, with offices in the Rialto Building, San Francisco. Mr. Hummel was formerly associated with the Pacific Gas & Electric Company and the Great Western Power Company, while Mr. Braunagel was manager of what has been known heretofore as the Rialto Electric Company.

The Wiener Machinery Company, 60 Church Street, New York, has been appointed sole representative in the United States and Canada for the Lanz locomobiles and tractors, made by Heinrich Lanz, of Mannheim, Germany. The officers of the Wiener Machinery Company are Felix F. Wiener, president; H. F. Hoevel, vice-president; E. G. Schmeisser, second vice-president; F. H. Scantlebury, sales manager; R. B. Franken, assistant to the president, and E. R. Singer, treasurer. A. Sachsse is mechanical engineer of the company.

New Industrial Companies

The Continental American Specialty Company, of Chicago, Ill., has been chartered with a capital stock of $100,000 to manufacture electrical goods and novelties. The incorporators are K. W. Kemper, G. Cohn and A. J. Alsdorf, of Chicago, Ill.

The Chicago Electric Shoe Shining Machine Company, of Chicago, Ill., has been granted a charter with a capital stock of $2,500 to do a general advertising, hardware and electrical business. The incorporators are E. A. Biggs, E. S. Carr and J. Rigney.

The Victor Lead Storage Battery Company, of Rock Island, Ill., has been incorporated by E. E. Winters, G. E. Brown and Walter E. Snider. The company is capitalized at $100,000 and purposes to manufacture and deal in all kinds of storage batteries.

The Aitken Electric Company, of Cleveland, Ohio, has been incorporated with a capital stock of $10,000 by S. E. Wilson, S. E. McFarland, George R. Aitken, S. M. Aitken and R. M. Zimmerman. The company purposes to do a general electrical contracting and construction business.

The W. J. Snyder Company has filed articles of incorporation under the laws of the State of Delaware with a capital of $100,000 for the purpose of carrying on an electrical and mechanical engineering business and also to manufacture machinery. The incorporators are I. T. Conway, L. A. Brownhill and M. E. Dorsey.

The Electro-Automatic Machine Corporation, of New Rochelle, N. Y., has been incorporated with a capital stock of $250,000 by J. H. Reid, of Ottawa, Canada; F. D. Lincoln, of New Rochelle, and E. E. Sullivan, Newark, N. J. The company proposes to manufacture and deal in electric machines, tools, implements, supplies, etc.

Trade Publications

Ceiling Sockets.—Harvey Hubbell, Inc., Bridgeport, Conn., has issued a leaflet illustrating large base sockets for 3-in., 3¼-in. and 4-in. outlet boxes.

Time Switches.—The Campbell Electric Company, Lynn, Mass., has issued an illustrated leaflet referring to its one-day and eight-day time switches.

Transformers.—The Packard Electric Company, Warren, Ohio, is mailing a leaflet referring to its porcelain-clad bell-ringing transformer. It is suitable for residence doorbells, buzzers and all classes of light signal work.

Cell Switches.—An improved device for end-cell switch control for large central-station batteries is the subject of Bulletin No. 145 published by the Electric Storage Battery Company, Philadelphia, Pa. The device is described and fully illustrated.

Lamps.—Advance information and prices of the new lighting units for 750-watt and 1000-watt tungsten-filament lamps are given in Bulletin No. 108 issued by the Holophane Works of the General Electric Company. Brief illustrated descriptions of these new units are included.

Pulmotor.—The Draeger Oxygen Apparatus Company, 422 First Avenue, Pittsburgh, Pa., has issued a descriptive catalog of the pulmotor, containing instructions for use. The interesting statement is made that this device has been successful in saving more than 500 lives in less than four years.

Construction Tools.—A large folder being distributed by T. J. Cope, 3244 North Fifteenth Street, Philadelphia, Pa., lists his many tools for underground electrical construction. Among those illustrated are the conduit-threading machine, the quick-coupling conduit rod, cable rack, manhole guards and others.

Grinders and Drills.—Portable emery grinders, electric and rope-driven, are described in a small folder recently issued by the Stow Manufacturing Company, Binghamton, N. Y. Several varieties of these grinders are illustrated. Bulletin No. 88 describes and illustrates the Stow two-spindle drill.

Motor Starters.—A large folder issued by the Allen-Bradley Company, Milwaukee, Wis., describes the operating characteristics of its motor starters. A fac-simile blue-print shows their construction. These starters are built in several forms to meet various conditions for starting single-phase and polyphase alternating-current motors.

Automobile Accessories.—An elaborate catalog of 174 pages lists and illustrates the automobile and boat accessories handled by the Wetmore-Savage Company, 76 Pearl Street, Boston, Mass. Practically every requirement of the motorist, repair man and dealer is cataloged. A pocket edition, without illustrations, of automobile and motorboat accessories is also being distributed by the company.

Therapeutic Outfit.—The Dubilier Electric Company, Inc., 80 Fifth Avenue, New York, is sending out Bulletin 100, which refers to its portable X-ray outfits for physicians and dentists. This machine is designed to do fluoroscopic as well as radiographic work on either alternating current or direct current. Some radiographs taken with this outfit are shown, and directions for operating the apparatus are given.

Electric Specialties.—An attractive catalog of eighty-eight pages has been issued by the G & W Specialty Company, 6306 Blackstone Avenue, Chicago, Ill. Its pot-heads of various types are fully described and amply illustrated. Other specialties are also considered, such as its safety line-disconnector, insulating compounds, series cut-outs and similar devices. This catalog of labor-saving appliances will be read with interest by central-station managers.

Electric Incubators.—The Standard Electric Incubator Company, 76 Greenwich Street, New York, has issued an illustrated booklet which gives some interesting information regarding its Standard electric incubators, portable hovers and winter brooders. The "Lo-Glo" incubator automatically regulates the amount of heat reaching the eggs and insures scientific exactness through the entire hatching process. Some excellent results have been reported from the use of this apparatus.

Personal Mention

Mr. Charles G. McAvoy is now associated with the Danville (N. Y.) Gas & Electric Company as superintendent. He formerly held a similar position with the Bellefonte (Pa.) Electric Company.

Mr. Philip Torchio, electrical engineer New York Edison Company, sailed for Europe on the *Imperator*, May 23. Mr. Torchio will spend a great part of his time in Germany and will return to New York June 25.

Mr. C. N. Duffy, vice-president and general manager of the Manila (P. I.) Electric Railroad & Light Company, has been elected president of the Manila City Club, an organization of business men recently formed to boom the Philippines.

Mr. George M. S. Schulz, Surrogate of the Borough of the Bronx, New York City, whose appointment as a member of the Public Service Commission of the First District of New York was announced in the *Electrical World* of April 4, has finally declined the appointment.

Mr. C. M. Clark, of Philadelphia, has been elected president of the Nashville (Tenn.) Railway & Light Company, succeeding Mr. Percy Warner, whose resignation was announced in these columns on May 9, 1914. Mr. Clark will continue as a director and as chairman of the board.

Mr. S. B. Irelan has been appointed manager of the Bartlesville (Okla.) Interurban Railway Company, which operates the electric railway between Bartlesvile and Dewey and also supplies electric-lighting service in Bartlesville. Mr. Irelan was formerly stationed at Fremont, Neb., with H. L. Doherty & Company, who are also the owners of the Bartlesville property.

Mr. F. W. Hoover, vice-president of the Chattanooga (Tenn.) Railway & Light Company, a subsidiary of the Tennessee Railway, Light & Power Company, has been made vice-president and general manager of the Nashville (Tenn.) Railway & Light Company, which is also a subsidiary of the Tennessee company. Mr. Hoover is also general manager of the Tennessee Power Company.

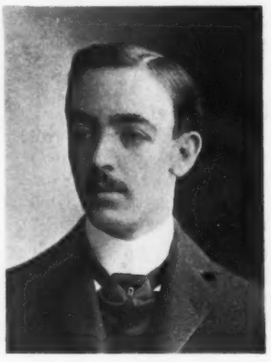
Mr. W. E. Moore, who has been general manager of the West Penn Electric Company and also of the West Penn Traction Company, will in the future have the title of vice-president and general manager. His jurisdiction in general will cover engineering construction and maintenance of way, transportation matters, operation of power plants, purchasing, sale of energy and the securing of new franchises and rights.

Mr. Montague Ferry has been appointed Commissioner of Public Service for the city of Chicago. The work placed in Mr. Ferry's charge results from the combination of several bureaus in the City Hall which are now dealing with public-service corporations and complaints relating to public service. An important part of the work will be the compiling of statistics which may later be valuable in the preparation of rate-regulation ordinances. Mr. Ferry has been connected with the department of gas and electricity of the city of Chicago. He is thirty-three years of age and an engineer by profession. He obtained his collegiate training in Yale University and the Massachusetts Institute of Technology. He has been connected with a number of telephone companies and at one time was in the office of McMeen & Miller, engineers, Chicago. He is an associate of the American Institute of Electrical Engineers and a member of several societies and clubs.

Prof. V. Karapetoff, of the Department of Electrical Engineering, Cornell University, has just completed an extended lecturing tour. On May 9 he spoke before the Eastern Association of Physics Teachers at Springfield, Mass., on the subject of "Some Calculations in the Magnetic Circuit." On May 11 he addressed the engineering students of the Case School of Applied Science, Cleveland, Ohio, on "The Production of Revolving Magnetic Field." On the same day he lectured before the Case School chapter of the Society of Sigma Xi on "The Dielectric Circuit." On May 12 he appeared before the engineering students of Carnegie Institute of Technology, Pittsburgh, and lectured on the subject of "Some Transient Electrical Phenomena." On the evening of the same day Professor Karapetoff delivered a paper before the Pittsburgh Section of the American Institute of Electrical Engineers on "The Preparation and Qualifications of a Teacher in Engineering." On May 13 he addressed the students of the University of Pittsburgh on the subject of "Electrification of Steam Railroads."

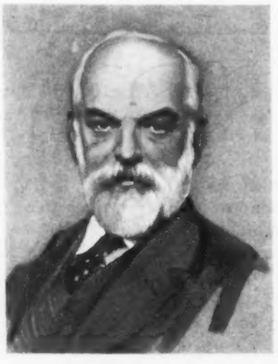
Obituary

Mr. Bert Ernest Semple, sales agent for the General Electric Company in its Chicago office, died on May 15, after nearly three months' illness. Born at Keokuk, Ia., in 1874, Mr. Semple received a high school education in Chicago and started to work for the General Electric Company as an arc-lamp repairman in the company's Chicago repair shop in 1894. In 1898 he was made foreman of the shop and in 1908 was transferred to the company's sales organization in the power and mining department, where he worked until overtaken by his last illness. A specialist on heavy-duty motor applications, Mr. Semple had much to do with the steel-mill electrification at Gary and other large plants of similar nature. Mr. Semple was an associate of the American Institute of Electrical Engineers and a member of the American Iron and Steel Institute, the Association of Iron and Steel Electrical Engineers, the Jovian Order, the Mystic Shrine of Medinah Temple and the Chicago Automobile Club. He is survived by a widow, a brother, Frank H. Semple, and a mother.



BERT E. SEMPLE

Robert Kaye Gray, well known in the electrical and telegraph industry of the world and past-president of the (British) Institution of Electrical Engineers, died April 28 and was buried at East Wickham, England, May 2. Robert Gray was born in Scotland, June, 1851, and went to London in 1865, where he entered the University College School and ultimately University College. He was engineer-in-chief of the Silvertown Company, the corporate name of which is the India Rubber, Gutta Percha & Telegraph Works Company, Ltd., and a director of four submarine telegraph companies. His whole career has been connected more or less intimately with the telegraph business. In 1870 he accompanied his father, the late Matthew Gray, to lay the cable from Gravelines to Bordeaux during the Franco-Prussian War. Two years later he acted as electrician-in-chief throughout the expedition for laying the direct Spanish cable from the Lizard to Bilboa and the Marseilles-Algiers cable for the French government. In later years his labors were directed toward developing an extensive manufacturing business, which demanded knowledge far wider than that associated with telegraphy and electric lighting. He was elected president of the Institution of Electrical Engineers in February, 1903, and visited the United States as a delegate to the International Electrical Congress in St. Louis in 1904. He was a member of the Institution of Civil Engineers, of the Institute of Metals, of the Royal Institution and of the Royal Society of Arts. He was instrumental in helping forward the National Physical Laboratory, and two years ago was appointed chairman of the executive committee of the Imperial College of Science.



ROBERT K. GRAY

Construction

New England

BANGOR, MAINE.—The electrical committee has submitted a report to the Council which recommends an appropriation of $2,500 for lighting the rural sections of the city.

MAPLETON, MAINE.—The Mapleton El. Co., recently organized, is building a substation and distributing system to furnish electric service here. Electricity for operating the system will be supplied by the Maine & New Brunswick Co., of Presque Isle, which will extend its transmission line into the village. The overhead line will require 300 cedar poles and 8 miles of wire. Aubrey C. Frost, of Limestone, is engineer in charge. A. E. Floyd is president of the company.

RUTLAND, VT.—The installation of an ornamental lighting system in the business district is under consideration. It is proposed to erect ornamental standards carrying five-lamp clusters. The Rutland Ry., Lt. & Pwr. Co. has the contract for street-lighting.

WATERBURY, VT.—The committee in charge of making investigations in regard to installing a municipal electric-light plant has engaged F. O. Sinclair, of Burlington, to investigate the proposal and prepare estimates of cost of same.

FALL RIVER, MASS.—Bids will be received by the Board of Fire Commissioners, Fall River, Mass., until May 26 for underground cable as follows: For approximately 3000 ft. of 8-conductor, 500 ft. of 6-conductor and 500 ft. of 4-conductor; all to be of No. 14 copper wire, 5/32-in. rubber-insulated, lead-incased cable. W. L. Booth is chairman of board.

MERRIMAC, MASS.—At special town meeting held recently it was voted to appropriate $1,000 to extend the electric-lighting system to the Haverhill line.

WAKEFIELD, MASS.—The municipal light board has signed a contract with the Edison El. Lt. Co. to furnish electricity to operate the municipal electric-light system at 2.68 cents per kw-hr., beginning Sept. 1. The municipal generating plant will be closed down.

WALTHAM, MASS.—The committee on public works has recommended that an engineer be engaged to plan a systematic arrangement of the street lamps in this city.

PROVIDENCE, R. I.—Mayor Gainer has signed the contract with the Narragansett El. Ltg. Co., of Providence, providing for special rates for electricity to operate the 30,000,000-gal. auxiliary pump at the Pettaconsett station. Commissioner of Public Works Slade has awarded the contract for furnishing and installing the pump to the Felber Engineering Corpn.

Middle Atlantic

FARMINGDALE, N. Y.—Bids will be received by Dr. Franklin W. Hooper, secretary board of trustees, 30 Lafayette Avenue, Brooklyn, N. Y., until June 13 for construction, heating, plumbing and electric work for the horticulture and agronomy buildings and director's cottage at the New York State School of Agriculture on Long Island, in Farmingdale. Bids will be received for each division of the work separately and no combination of bids will be considered. Drawings and specifications may be consulted and blank forms of proposal obtained at the office of the secretary, at the office of A. A. Johnson, director, Farmingdale, and at the office of Lewis F. Pilcher, state architect, Capitol, Albany.

ISCHUA, N. Y.—The Village Board has granted the Cattaraugus County Ltg. Co., of Olean, permission to erect transmission lines through the village of Ischua to furnish electricity for lamps and motors here. The company will also furnish electrical service in Franklinville.

LEHIGHTON, PA.—The Mauch Chunk Lt., Ht. & Pwr. Co., of Mauch Chunk, is reported to be negotiating for the property of the Lehighton El. Lt. & Pwr. Co.

PENN YAN, N. Y.—The Board of Electric Light and Water Commissioners will receive bids until June 1 for construction of addition to the power house of the municipal electric plant and water-works system.

ALLENTOWN, PA.—The Council has instructed the Mayor to ask for bids for supplying the several city buildings and pumping station with incandescent lamps for the remainder of the year.

AVOCA, PA.—The Borough Council has granted the Avoca Borough El. Lt. Co. a franchise to operate in this borough and a contract for lighting the streets.

BALDWIN, PA.—Bids will be received by D. S. Smith, secretary of Baldwin Township Public School District, Baldwin, until June 2 as follows: For general contract, plumbing, electrical wiring and heating of the Moore School building. Plans and specifications may be seen at the office of Edwin V. Denick, architect, 1212 House Building, Pittsburgh.

BUTLER, PA.—The City Council has awarded the contract for lighting the entire city by electricity to the Butler Lt., Ht. & Pwr. Co. For several years part of the city has been lighted by gas lamps. Cluster lamps will be used in the business section of the city.

CHAMBERSBURG, PA.—The Borough Council has adopted a resolution to make further improvements to the municipal electric-light plant, to include the installation of an additional 500-kw Fort Wayne turbo-generator, with condenser (Alberger Pump & Condenser Co.) and other accessories, the cost not to exceed $14,000.

HOLTWOOD, PA.—The Pennsylvania Wtr. & Pwr. Co. is reported to have placed orders for the installation of an additional unit with a rating of 16,000 hp at its Holtwood plant. This will increase the output of the plant to 110,000 hp, with provision for the installation of two additional units when required. A transmission line will be erected between the Holtwood plant and Baltimore. The cost of the work is estimated at about $400,000.

LANSDALE, PA.—Bids will be received by the Electric Light Department of the borough of Lansdale until June 1 for furnishing miscellaneous supplies for the municipal electric-light plant, including tungsten lamps, triple-braided copper wire, cross-arms, cross-arm braces, arc-lamp cord, etc. For details see proposal columns. R. S. Landis is chairman.

NESCOPECK, PA.—The Columbia Gas & El. Co. has submitted a proposal to the Council offering to install a street-lighting system consisting of 26 100-watt lamps.

PITTSBURGH, PA.—Bids will be received at the office of the city controller, Pittsburgh, Pa., until May 25, for the installation of an electric wiring system in the new market house in Diamond Square, to be erected by the city of Pittsburgh. Proposal blanks and specifications can be obtained at the office of the director of public works, Room 432, Oliver Building, Pittsburgh.

PITTSBURGH, PA.—Contracts have been awarded by the Duquesne Lt. Co., of Pittsburgh, for an installation of four 15,300-kw (each) turbo-generator sets, and for 20 additional boilers, which will give the plant when completed a total output of 100,000 hp. The Westinghouse El. & Mfg. Co. was awarded the contract for electrical equipment. The cost of the work is estimated at $600,000.

ASBURY PARK, N. J.—The City Council has awarded a contract for lighting the Railroad Square for a period of five years to the Atlantic Coast El. Lt. Co., under which the company will install 12 standards, carrying five-lamp clusters.

JERSEY CITY, N. J.—The Board of City Commissioners is reported to be considering plans for the installation of a refrigerating plant and vacuum-cleaning plant in the new city hospital, to be erected at a cost of $300,000.

MONTCLAIR, N. J.—Bids will be received by Frank J. Taylor, secretary of board of education, Montclair, N. J., until June 4 for construction of new High School building, to be located at Park Street, Chestnut Street and Midland Avenue, Montclair, as follows: (1) For entire work; (2) entire work exclusive of plumbing, heating and ventilation and electric wiring; (3) for all work specified under "plumbing"; (4) for all work specified under "heating and ventilation"; (5) for all work specified under "electric wiring." Drawings, specifications and full information may be obtained from Starrett & Van Vleck, 45 East Seventeenth Street, New York, N. Y., upon deposit of $25, of which $15 will be refunded upon return of above.

NEWARK, N. J.—The City Council has awarded the contract for the auxiliary engine and generator for the city hall plant to McGowan & McCabe, of Newark.

NEW BRUNSWICK, N. J.—The Public Service El. Co. has been awarded a three-year contract for the ornamental street-lighting system on Church and Peace Streets. The present lamps are to be replaced with 100-hour flaming arc lamps.

ROCK HALL, MD.—Bonds to the amount of $10,000, it is reported, have been voted for the installation of a municipal electric-light plant.

HUNTINGTON, W. VA.—The Chesapeake & Potomac Tel. Co., 5 Light Street, Baltimore, Md., contemplates the installation of a power plant to furnish power for the Ceredo-Kenova branch.

ROCKY MOUNT, VA.—The capital stock of the Light & Pwr. Co., of Rocky Mount, has been increased from $15,000 to $20,000.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until June 2 for furnishing at the various navy yards and naval stations supplies as follows: Schedule 6794—Brooklyn, N. Y., 15,500 ft. 2-in. galvanized steel conduit, 10-in. lengths and ¾ in. I. P. S. Bids will also be received until June 9 as follows: Brooklyn, N. Y., Schedule 6808—6300 admiralty metal condenser tubes, ⅝ in. O. D., 65 mils thick, 13 ft. 2¼ in. long. Norfolk, Va., Schedule 6808—2100 brass, admiralty mixture, seamless drawn evaporator tubes, 2 in. O. D., 5 ft. 10 in. long, 109 mils thick. Boston, Mass., Schedule 6800—6000 lb. galvanized crucible cast-steel wire. Bids will also be received until June 16 for furnishing 2840 7-in. by 1¼-in. batteries and 1440 flashlights without batteries, to be delivered at all yards as per Schedule 6793. Applications for proposals should give the schedule desired by number. T. J. Cowie is paymaster general, United States Navy.

North Central

IONIA, MICH.—Within the next 30 days the Ionia Wtr. Pwr. Co. expects to purchase one 150-kw generator O. S. Wood is secretary and manager.

KALAMAZOO, MICH.—The lighting committee of the City Council has recommended the purchase of 649 ft. of cable, a 30-kw transformer and a motor-generator set for the municipal electric-lighting plant.

LAKE CITY, MICH.—Charles L. Ostrander, owner of the local electric-light and water plant, expects to install a new pump in the near future.

MOUNT CLEMENS, MICH.—The Eastern Michigan Edison Co., of Mount Clemens, is contemplating the installation of an ornamental street-lighting system, to cost about $2,500. The plans provide for the erection of ornamental standards mounted with a 600-cp inverted luminous-arc lamp maintained by underground wires. Armored cable will be used. H. G. Hall is division manager.

PORTLAND, MICH.—Within the next three months the electric light commissioners expect to erect a new transmission line between the power house and substation. T. L. Jenkins is superintendent.

REED CITY, MICH.—The Osceola Lt. & Pwr. Co., of Reed City, expects to purchase within the next three months one 150-kw and one 250-kw, three-phase generator. The company has recently purchased the entire equipment of the steam plant formerly at Frankfort and will soon install the same. B. J. Stall is secretary and treasurer.

SPRINGPORT, MICH.—Within the next 30 days the electric light board expects to purchase six direct-current 220-volt meters. L. E. Landon is chairman of board.

TRAVERSE CITY, MICH.—The Boardman River El. Lt. & Pwr. Co., of Traverse City, contemplates the erection of 2 miles of three-phase, 7200-volt transmission line. W. S. Cook is manager.

BARBERTON, OHIO.—A bond issue of $20,000, recently authorized, has been sold. The city of Barberton, it is understood, will soon let contracts for the construction of an electric light and power system.

CLEVELAND, OHIO.—The Ohio Public Utilities Commission has granted the Cleveland Tel. Co. permission to issue $4,000,000 in notes, of which the proceeds of more than $3,000,000 will be used for refunding purposes and the remainder for improvements and extensions.

COSHOCTON, OHIO.—The Ohio Service Co., of Coshocton, has applied to the Public Utilities Commission for permission to take over the electric-light plant at Canal Dover, the electric and steam plant in New Philadelphia and the electric-lighting plants in Dennison and Uhrichsville, which are now controlled by the County El. Co., of New Philadelphia. In addition to these the company contemplates taking over the new transmission line of the Lafayette Lt. & Pwr. Co. now being erected from the central station in Coshocton to Cambridge, Dennison, Uhrichsville, New Philadelphia and Canal Dover. The plan also includes the purchase of the properties of the New Midland Pwr. & Trac. Co., which operates the electric-lighting, system, ice-manufacturing plant and street railway in Cambridge, and the electric railway extending from Cambridge to Pleasant City.

DAYTON, OHIO.—The residents of North Dayton have petitioned the City Commissioners for the installation of boulevard lamps on Troy Street and a portion of Valley Street.

FINDLAY, OHIO.—The Toledo, Bowling Green & Southern Trac. Co., of Findlay, has submitted a proposal to the City Council offering to forfeit the eleven years its present franchise has to run, pave the center of its tracks and lay 100-lb. rails in place of the present 72-lb. rails, if granted a 25-year franchise and a ten-year contract for street-lighting. The company also offers to install new street lamps.

HAMILTON, OHIO.—Plans are being considered for the installation of a 1000-kw generator and a battery of two boilers in the municipal electric-light plant.

MANSFIELD, OHIO.—Bids will be received by O. Hursh, director of public service, Mansfield, until July 1 for furnishing electric street-lamps for a period of ten years in accordance with specifications on file at the office of the director of public service, Mansfield, and at the office of H. Whitford Jones, consulting engineer, 1303 Citizens' Building, Cleveland, Ohio. For details see proposal columns.

SHREVE, OHIO.—The electric plant of the Gardner El. Lt. & Pwr. Co. was recently damaged by fire.

WEST LIBERTY, OHIO.—The Ohio El. Co. has applied for a 25-year tranchise to furnish electricity in West Liberty. C. A. Hartzler, owner of the local electric plant, it is reported, is preparing to give up the business.

WEST MILTON, OHIO.—The Council has awarded the contract for street-lighting to L. A. Pearson, owner of the local electric-light plant, for a period of ten years. The arc-lamps now in use will be replaced by tungsten lamps.

JEFFERSONTOWN, KY.—The Town Council has awarded the contract for the installation of new electric street lamps to H. C. Tafel, of Louisville, Ky.

LEXINGTON, KY.—The merchants have decided to install an ornamental street-lighting system in the business district. The plans provide for the erection of 88 standards carrying high-candle-power lamps. The cost of the installation will be borne by the merchants and the city will maintain the lamps.

ROCHESTER, IND.—The Public Service Commission has authorized the Rochester El. Lt., Ht. & Pwr. Co. to issue $50,000 in bonds, the proceeds to be used in extending a high-tension transmission line to Bourbon and for other improvements.

CHICAGO, ILL.—Bids will be received by John McGillen, clerk of the Sanitary District of Chicago, 910 South Michigan Avenue, Chicago, until May 28 for furnishing supplies, including 4.1-amp, 60-cycle, oil-immersed manhole-type impedance coils, tubular steel poles, arc-lamp windlasses, ornamental pole bases, Chicago pole bases, Chicago base pole seats, 5000-volt multiple-conductor, varnished-cloth, insulated, lead-covered cable. For details see proposal columns.

LANCASTER, ILL.—The Interstate Lt. & Pwr. Co., of Galena, Ill., has closed a 15-year contract with the Lancaster Lt. & Pwr. Co., of Lancaster, Wis., to supply electricity at 33,000 volts, to be distributed in the towns of Lancaster, Bloomington, Fennimore and Boscobel, Wis. The Lancaster company will erect a 17-mile transmision line to connect with the line of the Interstate company at Platteville.

SPRINGFIELD, ILL.—Acting on a petition from the property owners, the City Commissioners have authorized the installation of an ornamental lighting system on Adams Street in the downtown section covering 12 blocks. Ornamental standards carrying one lamp will be used. They will be double-wired and an experiment will be made with the new nitrogen lamps.

SPRINGFIELD, ILL.—The residents of West Grand Place, a suburb of Springfield, having been unable to make a satisfactory agreement for street-lighting with the Springfield Lt., Ht. & Pwr. Co. have organized the West Grand Improvement Association and have appointed a committee to investigate the feasibility of establishing an independent electric-light plant. Dr. W. G. Bain is president of the association and William Price secretary.

URBANA, ILL.—The contract for installing the ornamental street-lighting system in Urbana has been awarded to the Caldwell Co.

ALMOND, WIS.—The Almond El. Lt. Co., it is reported, contemplates the construction of a new power house and the installation of two new engines. Improvements are also contemplated to the street-lighting service.

POUND, WIS.—The Coleman-Pound Lt. & Pwr. Co. has been granted permission by the Railroad Commission to issue $6,000 in capital stock, the proceeds to be used for the construction of an electric-light plant to supply electricity in the villages of Coleman and Pound.

ROME, WIS.—The Bark River El. Lt. & Pwr. Co., of Rome, is planning to rebuild its hydroelectric plant, which was recently destroyed by fire. The company will soon purchase one 36-in. and one 23-in. turbine with harness and governors; also extend its transmission lines through rural districts, a distance of 12 miles. Connection has been made with the steam plant of the Sullivan Condensed Milk Co., of Sullivan, for emergency purposes. A. A. Lepper is secretary and engineer in charge.

ALEXANDRIA, MINN.—Bids will be received at the office of C. J. Sundblad, city clerk, until June 1 for additions to waterworks system at Alexandria, as follows: (1) Pump house and accessories; (2) reinforced-concrete reservoir, of approximately 300,000-gal. capacity, and accessories, together with pipe line and connection to present system; (3) pump of approximately 400 gal. capacity and a 35-hp to 40-hp motor and accessories with optional bids on same; (4) a drilled well, 16 in., 20 in. or 24 in. in diameter; (5) optional bid for reinforced-concrete dug well and accessories. Plans and specifications are on file in the office of the city clerk, Alexandria, and in the office of J. F. Druar, of the Oscar Claussen Engineering Co., Commercial Building, St. Paul.

BLUE EARTH, MINN.—The Electric Light and Water Works Commission expects to purchase within the next 30 days one motor-driven deep-well pump having a capacity of 250 gal. per minute and to install a new street-lighting system covering about 16 blocks. D. Fitch is superintendent.

ELY, MINN.—Bids will be received by Thomas E. Miller, secretary school board of Independent School District No. 12, St. Louis County, Minn., until June 1 for the construction complete of a 24-room school building as follows: (A) Main building, boiler house, stacks and two subways complete; (B) plumbing; (C) heating and ventilation; (D) electric wiring for both lamps and motors; (E) vacuum cleaning system. Plans and specifications are on file at the office of Thomas E. Miller, secretary of school board, Ely; at the office of C. Howard Parsons, architect, 601 Phoenix Building, Minneapolis, Minn., and at the Builders' Exchange in St. Paul, Minneapolis and Duluth, Minn.

GRAND RAPIDS, MINN.—Within the next three months the Electric Light Commission expects to install a pump having a capacity of 750 gal. per minute, to be driven by a 40-hp, three-phase, 60-cycle motor. F. H. Leonard is superintendent.

HUTCHINSON, MINN.—Bids will be received by F. N. Moore, city clerk, Hutchinson, Minn., until June 10 for the construction of a two-story brick city hall and fire station. Separate bids will be received at the same time for electric wiring, heating and plumbing. Plans and specifications are on file in the office of F. N. Moore, city clerk, Hutchinson, and at the office of C. E. Bell, architect, Security Building, Minneapolis, Minn.

MELROSE, MINN.—Bids will be received by the city of Melrose until May 26 for furnishing one 100-kw, two-phase, 2300-volt (engine-type) generator, directly connected to suitable engine. Specifications are on file in the office of F. J. Weisser, city clerk.

WHITE BEAR LAKE, MINN.—The Village Council has voted to install an ornamental street-lighting system, consisting of 28 standards. Dependent upon the subscriptions of merchants, the initial installation will consist of 40 posts. Electricity for maintaining the lamps will be furnished by the Consumers' Pwr. Co.

BOONE, IA.—The Fort Dodge, Des Moines & Southern R. R. Co., of Boone, is contemplating erecting a transmission line from its plant at Frazier to Jewell, a distance of 40 miles, to furnish electricity to towns along the line. The cost of the line is estimated at $30,000.

DAVENPORT, IA.—The contract for street-lighting has been awarded to the People's Lt. Co. The new contract is for a period of five years and will provide for an increase from 350 lamps to 650 lamps.

DES MOINES, IA.—The Des Moines Ry. & Lt. Co. has changed its name to the Des Moines & Central Iowa El. Co. and increased its capital stock from $500,000 to $1,000,000, the proceeds to be used to build a heating plant in Des Moines and a transmission line from Des Moines to Oskaloosa. The company owns and operates plants in Des Moines, Oskaloosa, Colfax, Valley Junction, New Sharon, Montezuma and Prairie City.

WAUCOMA, IA.—At an election held May 12 the proposal to issue $12,000 in bonds to construct a municipal electric-light plant was carried for the second time. The election held early in March was found not legal. It is understood that the Council will soon ask for bids for construction of the dam and installing power plant.

KANSAS CITY, MO.—The Dorn-Cloney Laundry Co., of Kansas City, it is reported, contemplates the erection of a separate power plant, to cost about $10,000. E. Dorn has charge of the plans.

KNOBNOSTER, MO.—The Knobnoster Brick, Tile, Lt. & Pwr. Co., recently incorporated, contemplates furnishing electricity for lighting the city from the plant at its brick and tile plant. James B. Millar is secretary.

ST. LOUIS, MO.—Bids will be received by the Board of Public Improvements until May 26 as follows: Letting 11,225, for generator house for Chain of Rocks filters; Letting 11,226, engine and generators for above; Letting 11,227, motor generator sets for same. Plans and specifications and form of contract may be obtained at the office of the water commissioner, New City Hall, upon deposit of $10, which will be refunded upon return of same.

SULLIVAN, MO.—The Sullivan Ice, El. Lt. & Pwr. Co., recently incorporated, is installing an electric-light plant here. The equipment will consist of three O'Brien boilers, of 175 hp each, 150 lb. pressure; two Corliss engines, one 200-kw General Electric alternating-current generator, switchboard, and three substations, one to be erected at St. Clair, the second at Cuba and the third at Steelville. About 40 miles of pole line will be erected (40 poles per mile); 550 General Electric meters will be used; about 400 incandescent street lamps of 48 cp and about 6000 incandescent lamps of 16 cp will be required for residential lighting. John F. Peterson, of Sullivan, is engineer in charge. R. Zinkman is vice-president.

UNIVERSITY, MO.—The University City Improvement Association is contemplating changing the street-lighting system from gas to electricity. The El. Co. of Missouri, of St. Louis, has offered to furnish 70-cp lamps, mounted on ornamental concrete standards, at $12 each per year, in consideration of a 10-year lighting franchise.

ALEXANDER, S. D.—As yet no definite action has been taken toward the construction of the proposed municipal electric-light plant, and no engineer has been engaged. Reported in the issue of May 9 to have issued $16,000 in bonds for plant. H. M. Schumacher is city auditor.

COLDWATER, KAN.—Within the next two months the Municipal Water & Light Department expects to purchase one 100-hp oil engine and a 75-kw, three-phase, 60-cycle, 2300-volt generator, directly connected, one 25-hp motor and switchboard for above unit. L. A. Baldwin is superintendent.

WICHITA, KAN.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until June 15 for the removal of present elevator and installation complete of a new hoistway, an electric passenger elevator and a new hydraulic lift, etc., in the United States post office, court house at Wichita. For details see proposal columns. O. Wenderoth is supervising architect.

Southern States

GREENVILLE, N. C.—Bids will be received by the Water and Light Commission of Greenville until May 27 for furnishing and installing one 500-kw turbo-alternator, one 500-hp water-tube boiler, one surface condenser, and one open-feed-water heater. General specifications and proposal forms may be obtained from the superintendent at Greenville, and further information from William M. Piatt, engineer, Durham, N. C. H. L. Allen is superintendent.

HERTFORD, N. C.—Bonds to the amount of $12,000 have been voted for the installation of a municipal electric-light plant.

NEWBERRY, S. C.—Plans are being considered by the Commissioners of Public Works for the installation of an ornamental street-lighting system. Present plans provide for the erection of 75 hollow iron posts, 15 ft. high, each to carry three-lamp or four-lamp clusters.

CARROLLTON, GA.—The city of Carrollton is reported to have engaged McCormick & Fahy, engineers, Cherokee Life Building, Rome, Ga., to prepare plans for a municipal electric-light plant.

BINGHAMTON, TENN.—The works, including the power plant, of the America

Car & Foundry Co., at Binghamton were badly damaged by fire recently. It is understood that the plant will be rebuilt at once.

LEBANON, TENN.—The city of Lebanon would consider a proposition to sell an electric-light and water franchise. The city owns the electric distributing system and purchases energy for operating the same. The town has a population of about 5000.

LIVINGSTON, TENN.—The city of Livingston is prepared to grant a franchise for an electric light and power plant. For further information address E. C. Knight, secretary of Chamber of Commerce.

NEWPORT, TENN.—The City Council has granted C. L. Goughnour a franchise to install and operate an electric-light system in Newport. Mr. Goughnour proposes to build a reinforced-concrete dam across the Pigeon River at Hartford, where an electric plant will be erected.

LUVERNE, ALA.—The town of Luverne contemplates the installation of an additional generating unit (consisting of generator and engine, directly connected) and rotary water pumps.

LAUREL, MISS.—Within the next two months the Laurel Ry. & Lt. Co. expects to build an additional fuel room to its power house; also to purchase one 750-kw turbine and material for 1½ miles of overhead trolley line. S. M. Jones is secretary and treasurer.

HELENA, ARK.—The City Council has authorized the installation of 40 additional street lamps.

ARDMORE, OKLA.—The property of the Ardmore Trac. Co. has been taken over by Chicago parties, to be operated under the name of the Ardmore El. Ry. Co. The new owners will make extensive improvements and additions to the system. George S. Cravens is president of the company.

BUFFALO, TEX.—The city of Buffalo has granted Andrew J. Holmes, of Carthage, Tex., a 25-year franchise to install and operate an electric-light plant here.

EL PASO, TEX.—Bids will be received at the office of the Depot Quartermaster, El Paso, until June 3 for construction of and installation of plumbing, heating, electric wiring and fixtures in one set of non-commissioned officers' quarters at Fort Bliss. Plans and specifications may be obtained at the above office upon deposit of $10, to be refunded upon return of same.

GAINESVILLE, TEX.—Contracts, it is reported, have been awarded by the Texas Pwr. & Lt. Co. for the construction of an electric-light plant in Gainesville, to cost about $50,000.

ROCKDALE, TEX.—The city of Rockdale is reported to be contemplating the installation of an ornamental street-lighting system.

Pacific States

EVERETT, WASH.—The Puget Sound Trac., Lt. & Pwr. Co. will install series tungsten lamps to replace the present series inclosed arc-lamps. The contract calls for 27 lamps of 350 cp, 216 of 200 cp, and 295 of 100 cp. No ornamental standards will be used. The cost of the work is estimated at $7,000. The work will be done by the company under the supervision of J. W. Hoover, city engineer.

SEATTLE, WASH.—Plans are being considered by J. D. Ross, superintendent of lighting, for the installation of a lighting system for the alleys in the business district, to cost from $8,000 to $10,000.

SEATTLE, WASH.—A resolution has been introduced into the City Council providing for the installation of cluster lamps on Madison Street, Marion Street and Columbia Street, each from Railroad Avenue to First Avenue.

SEATTLE, WASH.—The Commissioners of King County have granted the Vashon El. Co. a franchise to construct and operate an electric-light and power system on Vashon Island for a period of 50 years. The grant covers 55 roads and 27 additions and specifies that the company must begin work on system in 90 days. Homer H. Edwards is president and E. L. Stiles, of Tacoma, is attorney.

SPOKANE, WASH.—The City Council has granted the Washington Wtr. Pwr. Co., Spokane, a franchise to construct and operate an electric railway upon certain streets in the city.

OAK PARK, CAL.—The installation of an ornamental street-lighting system on Thirty-fifth Street and Sacramento Avenue is under consideration by the Business Men's Association.

RIVERSIDE, CAL. — The Southern Sierras Pwr. Co., of Riverside, has awarded the contract for the erection of its high-tension transmission line from Banning to El Centro, a distance of 131 miles, to the City El. Supply Co., of Riverside. The line will be of aluminum cable and will carry 55,000 volts. The City Supply Co. also has the contract to erect the new section of steel transmission line through Victorville to Oro Grande for the Southern Sierras Pwr. Co. J. W. Finch, of the City Supply Co., will have charge of the work.

SAN FRANCISCO, CAL.—Bids will be received at the office of the Board of Prison Directors, Room 13, Ferry Building, San Francisco, until June 5 for furnishing supplies to San Quentin and Folsom state prisons, consisting of subsistence stores, fuel, oil and electric appliances for jute mill at San Quentin, cement, etc., from July 1, 1914, to June 30, 1915.

VISALIA, CAL.—The State Railroad Commission has granted the Mount Whitney Pwr. Co., of Visalia, permission to issue $500,000, to be sold at 95. Of the proceeds $112,000 will be used for the construction of the Wolverton dam; $75,000 to complete the Keweah plant; new substations as follows: Woodville, $31,000; Rarlimart, $20,500; Goshen, $13,000; Strathmore, $11,500; Terea Bella, $15,000. Expenditures on substations already erected will be made as follows: Tulare, $29,087; Tipton, $53,469; Delano, $20,464; Porterville, $16,337.

CLEAR LAKE, IDAHO.—The Clear Lake Pwr. & Improvement Co. has applied to the Public Service Commission for a franchise to furnish electricity for lamps and motors to residents of Twin Falls County and to erect transmission lines from its plant on Clear Lake, in Gooding County, to Twin Falls County. The power plant of the company is nearly completed. The company was recently incorporated with a capital stock of $750,000. William C. Hazard, of Milwaukee, Wis., is president.

MOAB, UTAH.—Plans are being considered by C. A. Hammond, of Moab, and Joseph W. Christensen, of Fairview, for the installation of an electric-light plant in this city, estimates of cost of which are being prepared by A. V. Richards, of the firm of Caldwell & Richards, engineers, of Salt Lake City.

MONTICELLO, UTAH. — Preliminary surveys and estimates for the installation of an electric-light plant in Monticello, it is reported, have been made by A. V. Richards, of the firm of Caldwell & Richards, engineers, of Salt Lake City.

BAKER, MONT.—Preparations are being made by Ernest Heinrich for the installation of an electric-light plant in Baker. The equipment will include one horizontal tubular boiler (54 in. by 16 ft.), one 10-in. by 30-in. simple Corliss engine, one 50-kva, single-phase, 60-cycle, 2300-volt, 900-r.p.m. generator with switchboard; one carload of 30-ft. and 35-ft. (6-in.-top) poles, 50 meters and 500 25-watt tungsten lamps. Mr. Heinrich will have charge of the work.

MONTE VISTA, COL.—The San Luis Valley Tel. Co., recently incorporated with a capital stock of $1,000,000, proposes to build an independent telephone system in this section of the State. R. G. Breckenridge, of Monte Vista; James D. Pilcher, of Alamosa; Charles A. Gailbreath, of Del Norte, and others are among the incorporators.

PITKIN, COL.—Preliminary surveys, it is reported, are being made for the proposed hydroelectric power plant for the Brant Independent Mining Co. in Pitkin.

Canada

VANCOUVER, B. C.—Property owners in the district between Government and Douglass Streets on Cormorant Street have petitioned the City Council for the installation of cluster lamps. The city engineer has been instructed to prepare plans and estimates for same.

WINNIPEG, MAN.—The fire, water, light and power committee of the City Council has recommended a plan for the extension of the ornamental lighting system on Portage Avenue from Carlton Street to Maryland Street, with underground connections throughout, to cost about $50,000.

CANSO, N. S.—We are informed that the contract for the installation of an electric-lighting system has not yet been awarded. The town is installing a gas producer and engine to drive the plant. S. H. Moffatt is town clerk.

Miscellaneous

PANAMA—Bids will be received at the office of the general purchasing officer, Panama Canal, Washington, D. C., until June 3 for steel derricks complete with operating hoists, electroliers, wrought iron and steel pipes, etc. Blank and general information relating to this circular (No. 853) may be obtained at the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and 1086 North Point Street, San Francisco, Cal. Major F. C. Boggs is purchasing officer.

New Incorporations

WASHINGTON, ARK.—The Haygood Seminary Lt. & Trac. Co. has been incorporated with a capital stock of $25,000. R. Carter is president.

ST. MARY'S, GA.—The St. Mary's Ice & Lt. Co. has been incorporated with a capital stock of $6,000 by S. C. Townsend, C. S. Johnson, J. F. Hughes and others.

FORT GEORGE, B. C., CAN.—The Northern Interior Lt. & Pwr. Co. has been incorporated with a capital stock of $50,000.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED MAY 12, 1914.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York, N. Y.]

1,096,020. SAFETY TROLLEY WHEEL; J. A. Burton, Covington, Ky. App. filed Aug. 8, 1911. Toggle levers spread the guard plates.

1,096,048. MAGNETO GENERATOR; J. L. Milton, Tiffin, Ohio. App. filed Oct. 28, 1910. Employs malleable-iron casting in the make-and-break mechanism.

1,096,061. ELECTRO-PNEUMATIC CONTROL APPARATUS; W. M. Scott, Philadelphia, Pa. App. filed Oct. 25, 1910. For disconnecting such portions of a third rail as may become grounded.

1,096,065. ELECTRIC TUNING DEVICE; E. G. Stalnaker (minor), Chicago, Ill. App. filed June 21, 1912. For varying inductance and capacity.

1,096,085. ELECTROLYTIC PROCESS AND APPARATUS; C. White, London, England. App. filed Oct. 7, 1913. For removing gaseous anion and restraining same from again being taken up by the electrolyte.

1,096,108. TELEPHONE SYSTEM; B. G. Jamieson, Chicago, Ill. App. filed Aug. 15, 1911. Particularly for private-branch exchange switchboards.

1,096,109. CIRCUIT CONTROLLER; A. A. Kent, Philadelphia, Pa. App. filed Dec. 22, 1906. For internal-combustion engine ignition.

1,096,125. DEVICE FOR FACILITATING THE LOCOMOTION OF PERSONS SUFFERING FROM LOCOMOTOR ATAXIA; S. L. Pidot, St. Joseph, Mo. App. filed Oct. 20, 1913. Electrical impulses imparted to the body and controlled by switches on shoes of wearer.

1,096,127. TELEPHONE RECEIVER; A. Rosenberg, London, Eng. App. filed Jan. 24, 1912. Watch-form receiver for deaf persons.

1,096,136. ELECTRIC SIGNAL AND RECORDING SYSTEM; A. L. Sohm, Los Angeles, Cal. App. filed April 20, 1910. For registering and recording times of arrival and departure of employees of a system.

1,096,138. Electric Connector; J. C. Stearns, Worcester, Mass. App. filed Dec. 22, 1913. Plug connection for auto lamps.

1,096,142. Ethereal-Wave-Responsive Device; E. Weintraub, Lynn, Mass. App. filed Oct. 27, 1909. Wave-responsive element comprising essentially conductive borer.

1,096,151. Spark Indicator; C. D. Bremer and J. L. Moloney, Milwaukee, Wis. App. filed Dec. 30, 1912. Exposed spark-gap for indicating operativeness of sparking circuit.

1,096,153. Telephone Transmitter; E. B. Craft, Hackensack, N. J. App. filed July 9, 1910. Has electrode in the form of a tubular bolt.

1,096,155. Firing Mechanism of Breech-Loading Guns; A. T. Dawson and G. T. Buckham, Westminster, London, Eng. App. filed Aug. 11, 1911. Firing contact mechanism operable from handle of the hand wheel in any position thereof.

1,096,158. Apparatus for Testing Castings; E. I. Dodds, Central Valley, N. Y. App. filed Feb. 11, 1910. By formation of separate comparative magnetic circuits in the casting.

1,096,175. Electric Transmission of Intelligence; I. Kitsee, Philadelphia, Pa. App. filed Oct. 2, 1908. By submarine cable.

1,096,182. Transmission System; D. D. Miller, New York, N. Y. App. filed Oct. 4, 1913. For tapering resistance along a line so that all responsive devices along the line will receive approximately same amount of current.

1,096,205. Electrode Point for Spot-Welding Machines; A. C. Taylor, Warren, Ohio. App. filed Aug. 7, 1911. Has a channel for water circulation between the caps and the tapered electrode points to which the caps are applied.

1,096,215. Signal Device; G. L. Barrett, Springfield, Ohio. App. filed July 29, 1912. Single-stroke signal bell.

1,096,243. Secondary Winding for Induction Motors; T. Hoock, Wilkinsburg, Pa. App. filed June 6, 1911. Ends of conductor bars bent over into overlapped engagement.

1,096,276. Gas Igniter; H. B. Steele, Boston, Mass. App. filed May 10, 1912. For auto-gas lamps; platinum coil held in recess in burner tip.

1,096,277. Gas Controlling and Lighting Mechanism; H. B. Steele, Boston, Mass. App. filed Jan. 2, 1913. Valve construction for lighting and governing auto gas lamps.

1,096,287. Adjustable Mounting of Armatures of Electromagnets; E. B. Craft, New York, N. Y. App. filed May 7, 1908. Armature mounting for polarized bell ringers.

1,096,289. Electric Resistance Unit; O. Dale, New York, and H. A. Frederick, Tuckahoe, N. Y. App. filed Dec. 6, 1911. For heating devices; has reflexed resistance material folded longitudinally to provide for radiation in all directions.

1,096,292. Self-Scoring Target; M. St. Ellis, United States Navy. App. filed May 16, 1913. Sectional target face acted on by impact of bullets to close indicating circuits.

1,096,321. Electric Furnace; A. Scott-Hansen, Christiania, Norway. App. filed Jan. 6, 1914. Currents of gas or air blown toward the flame disk to assume form of truncated cones.

1,096,379. Trolley; C. H. Light, Des Moines, Ia. App. filed May 26, 1913. Trolley carried by laterally movable carriage on upper end of trolley pole.

1,096,390. Osmo Anti-Cathodic Vacuum Regulator for X-Ray Tubes; C. Regaud, Lyons, France. App. filed April 9, 1912. Conducts gas into operative relation to the anticathode.

1,096,411. Arc Lamp; A. Blondell and G. Dobkevitch, Paris, France. App. filed Jan. 16, 1905. Regulating mechanism for luminous arc lamps.

1,096,413. Alarm Shield; C. J. Coleman, New York, N. Y. App. filed May 25, 1910. Shield over safe door to give alarm when attempt is made to gain access to safe.

1,096,414. Electric Furnace; W. D. Coolidge, Schenectady, N. Y. App. filed Sept. 23, 1908. Tube of alumina wound with coil of platinum.

1,096,421. Pull Chain Guide; E. H. Freeman, Trenton, N. J. App. filed Sept. 1, 1911. Detachable from lamp socket shell.

1,096,422. Cap-and-Shell Fastening for Lamp-Socket Casings; E. H. Freeman, Trenton, N. J. App. filed May 17, 1913. Bayonet slot and slidable latch.

1,096,434. Telephone-Transmitter Cut-Out; A. R. Langdon, Hartford, Conn. App. filed Jan. 8, 1913. Push-button for temporarily cutting transmitter out of circuit.

1,096,440. Lamp; G. C. Lynch, New York, N. Y. App. filed Dec. 31, 1912. Table lamp with swivel connection permitting lateral shifting of the illuminating portion, including the light proper.

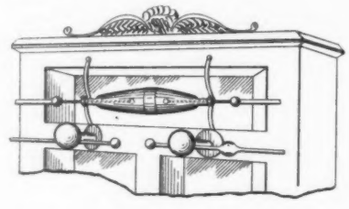
1,096,456. Culinary Article; C. Nelson, Brooklyn, N. Y. App. filed Sept. 8, 1909. Heating attachment for existing non-electric chafing dishes.

1,096,457. Connector Stand; F. J. Ravlin and J. Lofgren, Chicago, Ill. App. filed Jan. 31, 1913. For lamp extensions used in locomotive roundhouse.

1,096,459. Ignition Device; G. B. Reisbach, Milwaukee, Wis. App. filed July 25, 1910. Operated by electromagnets.

1,096,470. Automatic Controller for Electric Circuits; L. Stern, Philadelphia, Pa. App. filed Oct. 29, 1912. High or low water-level indicator.

1,096,475. Electrically Heated Implement; E. C. Van Glahn, New York, N. Y. App. filed Oct. 23, 1913. Soldering iron.



1,096,601—Muffler for Electrostatic Machines

1,096,484. Holding Device for Telephone Receivers; K. H. Atherton, Carson City, Nev., and M. N. Rodgers, Chicago, Ill. App. filed May 24, 1913. Constructed so that when receiver is pulled forward to listening position circuit will be closed in usual way.

1,096,485. Electric Switch; T. E. Barnum, Milwaukee, Wis. App. filed June 29, 1910. Drum controller.

1,096,493. Load-Regulated Governing Device for Fluid Pressure; J. S. Doyle, Mount Vernon, and F. Hedley, Yonkers, N. Y. App. filed Aug. 23, 1912. Braking pressure governed according to load on car.

1,096,498. Automatic Return Hook; H. L. Flanary, Roaringfork, Va. App. filed Sept. 22, 1913. For mine locomotives.

1,096,506. Electric Welding Apparatus; E. E. Haskin, New York, N. Y. App. filed Sept. 20, 1913. For welding heads or ends on tanks.

1,096,526. Pneumatic Tire Trouble Indicator; F. H. Brunig, Kansas City, Mo. App. filed Aug. 29, 1913. Sounds alarm when puncture occurs.

1,096,536. Automatic Synchronizer Indicator for Clocks; E. A. Hummel, St. Paul, Minn. App. filed Aug. 10, 1911. Indicates whether clock was synchronized at the proper time.

1,096,548. Switch Box; C. C. Maison, Cleveland, Ohio. App. filed June 17, 1912. Unit knock-out box adapted to be built up into gangs.

1,096,571. Signal Apparatus for Automobiles; M. C. Stamm, Chicago, Ill. App. filed Nov. 11, 1912. Warning automatically sounded when car turns corner.

1,096,587. Electric Accumulator; M. L. Ashbaugh, Anderson, Ind. App. filed April 12, 1913. Battery element divisible into plurality of superposed parts.

1,096,601. Muffler for Electrostatic Machines; L. C. Charbonneau, Brooklyn, N. Y. App. filed April 27, 1912. Joined conical members inclosing the spark-gap.

1,096,618. Conduit Wire Fishing Reel; G. Fussell, Portland, Ohio. App. filed Jan. 2, 1912. Portable conduit "fishing" device.

1,096,625. Ignition System for Internal-Combustion Engines; A. C. Gundy, Upland, Cal. App. filed June 15, 1912. Uniform period of circuit closure irrespective of engine speed.

1,096,627. Take-Down Apparatus for Handling Glass Cylinders; H. F. Hitner, Mount Vernon, Ohio. App. filed Aug. 18, 1911. Motor control for moving the glass cylinder from the vertical to a horizontal position.

1,096,636. Coated Article; P. McIlroy, Pittsburgh, Pa. App. filed Oct. 16, 1913. Steel-pipe conduit with strike coating of copper and zinc and a second coating of zinc.

1,096,676. Telephone Receiver; S. G. Brown, London, England. App. filed March 27, 1911. Has conically formed aluminum diaphragm.

1,096,677. Telephone Transmitter; S. G. Brown, London, England. App. filed Jan. 3, 1912. Has conical light aluminum diaphragm.

1,096,680. Electric Clock; E. E. Clement, Washington, D. C. App. filed May 25, 1909. Provided with hour strike and chime bells.

1,096,681. Time-Control Element for Electric Clocks; E. E. Clement, Washington, D. C. App. filed April 18, 1910. Pendulum construction.

1,096,688. Wear-Resisting Body and Method of Making the Same; C. Dantsizen, Schenectady, N. Y. App. filed Feb. 6, 1912. Die consisting of aluminum oxide sintered in its approximate shape.

1,096,691. Apparatus for Taking Photographs with Röntgen Rays; F. Dessauer, Aschaffenburg, Germany. App. filed Nov. 8, 1909. For effecting an extremely rapid exposure.

1,096,692. Apparatus for Making Instantaneous X-Ray Photographs; F. Dessauer, Frankfort-on-the-Main, Germany. App. filed Nov. 8, 1909. Embodying direct-current transformer and high-capacity condenser.

1,096,699. Connecting Clip for Electrical Conductors; J. G. Elkin, New York, N. Y. App. filed June 11, 1913. Spring-pressed jaws to engage with insulated conductor.

1,096,717. Oscillator for Wireless Transmission; C. D. Herrold, San José, Cal. App. filed April 21, 1913. For producing oscillating currents of high frequency.

1,096,726. Pocket Lantern; W. Knoff, Berlin, Germany. App. filed May 16, 1912. Of pistol shape with slidable cover.

1,096,729. Automatic Block System; H. G. Kurtshals, Somerset, Pa. App. filed Oct. 22, 1912. Apparatus at ends of blocks operated by the visual signals.

1,096,741. Trolley Switch; J. G. Munson, Cedar Rapids, Ia. App. filed March 31, 1913. Automatic switching device for trolley wheels.

1,096,751. Negative Electrode for Alkaline Secondary Batteries; H. P. R. L. Porscke and J. A. E. Achenbach, Hamburg, Germany. App. filed Jan. 7, 1913. Electrolyzes metal-ammonium compound and deposits metal liberated on a finely divided metal mass.

1,096,754. Electric Regulator. F. E. Ricketts, Baltimore, Md. App. filed April 15, 1909. For controlling field of alternating-current generators.

1,096,755. Automatic Electric Regulator; F. E. Ricketts, Baltimore, Md. App. filed July 23, 1910. Automatic switch responsive to voltage of each step of the series of machines.

1,096,765. Method of Collecting Particles Present in an Ionized Medium; W. W. Strong, Mechanicsburg, Pa. App. filed Dec. 28, 1912. For indicating presence of smoke in gases given off by a furnace.

1,096,777. Air-Brake-Control-Valve Mechanism; A. J. Allard, Richmond, Va. App. filed June 2, 1913. Electrically controlled to accomplish gradual application of brakes.

1,096,786. Method of and Apparatus for Producing Filled Precious-Metal Wire, Etc.; F. Kammerer, Pforzheim, Germany. App. filed Dec. 27, 1913. Electrolytic process with mechanical pressure.

1,096,800. Rheostat for Toy Electric Railways; F. Dangel, Nuremberg, Germany. App. filed March 9, 1914. Housed in one of the ties of the track.